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ABSTRACT

In 1972, the welding department personnel at Blackhawk Technical Institute in Wisconsin undertook the project of updating the curriculum of their one-year welding degree program. A study was conducted of local welding industries to determine hiring policies, the tools and equipment a beginning welder should purchase, the types of welding processes used, and professional ratings of skills required of novice welders. Sixty-nine out of the ninety-one companies known to do welding in the Blackhawk Technical Institute District were asked to participate in the study, and forty-three of these were eventually interviewed. Based on their responses, it was concluded that (1) most companies are willing to aid schools seeking their advice on curriculum revision, (2) modern (semi-and/or fully-automatic) welding processes must be introduced into businesses because of the lack of skilled welders, and (3) industry is willing to hire trained graduates of welding programs. Also, it was recommended that similar studies be conducted every three to five years to update the curriculum. (The appendixes give the following information: names and addresses of companies asked to participate and interviewed, samples of letters and forms used in the survey, and a copy of the survey instrument.) (EIG)

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Field Study

421 - 890

A WELDING SURVEY OF THE
BLACKHAWK TECHNICAL INSTITUTE
INDUSTRIES

(UP-DATING THE WELDING CURRICULUM)

by

Gerald E. Lesch

CE-019 466

March 9, 1975

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
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ACKNOWLEDGMENT

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I have become indebted to so many people in the process of assembling materials for this study that it is difficult to decide where to start, or stop, in expressing my appreciation. A great many people, during my interview with them, answered my inquires, filled out my survey instruments, and often provided me with materials and insights that had not occurred to me. Some would, I know, not wish to be identified; thus, I shall simply try to list a few to whom I feel especially indebted.

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John Entorf	- University of Wisconsin - Stout, Menomonie, Wisconsin
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Noah Shaw	- Welders Supply Company, Beloit, Wisconsin

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CHAPTER I

PROBLEM AND RATIONALE

Introduction

In 1972, the welding department personnel at Blackhawk Technical Institute committed themselves to the task of up-dating the welding curriculum. The curriculum is a one-year vocational diploma program of intensive learning activities which are especially designed and arranged to meet the needs of the students and industries in the District.

At Blackhawk Tech, the Welding Advisory Committee Members¹, School Administrators and Board of Education Members, felt that, in order to meet the students' and industries' needs the welding curriculum should be up-dated and validated every three to five years. Hence, the following pages describe the procedures and methods used in setting-up, administering, and evaluating a study, the first in a series of studies, undertaken in fulfillment of that commitment.

¹See Appendix A. p. 74.

Summary

The forty-three participating industries were representative of the Blackhawk Tech District - Rock and Green counties. The study covered the total range of welding industries rather than just a select population.

The respondents, in informal conversations, expressed the feeling that they were well satisfied with the procedure used in collecting the data. They felt that the information collected, since it was done on a personal interview basis, would be valid and that the results should provide the proper data for making judgments and curriculum decisions. Several respondents, as a result of the interviews, have (1) hired vocationally trained weldors, (2) sent some of their employees to Blackhawk Tech for up-grading, (3) requested school literature, and (4) donated equipment and/or supplies to the school.

The respondents, as a result of the study, also felt that: (1) an exchange of ideas and information with school officials and program instructors was beginning to take place; (2) another study of this kind should be conducted in three to five years; (3) studies will aid the school to attain its goals, prepare weldors for work, and improve public relations; (4) education for the future must stress skill and more knowledge of automation; (5) vocational graduates have an important place in life and work with an education of less than a baccalaureate degree.

Problem

The problem of this study in Blackhawk Technical Institute, is to assess, through the use of a research survey the current employment trends, educational skills and competencies beginning weldors should possess before seeking employment in the District.

Objectives

The objectives of this study are to:

- (1) identify the trends and hiring policies of the welding industries in Rock and Green counties.
- (2) identify the tools and equipment a beginning weldor should purchase upon being employed in the welding firms in Rock and Green counties.
- (3) identify the kinds of welding processes, their magnitude ratings and future trends, presently being used in the welding industries of Rock and Green counties.
- (4) identify the professional ratings of the tasks industry feels beginning weldors should know and be able to perform before being employed in the welding industries of Rock and Green counties.

Rationale

Curriculum revision movements are underway today in nearly all subject areas being taught in the vocational, technical institutes. This is because of the dynamic technological and scientific advances being made from day to day in all areas of industry. In the welding industry alone new discoveries and techniques are being disclosed daily. Information concerning them must be made available to the schools if they are going to continue to teach the skills and knowledges students should possess for employment. The failure to get this information from industry will only widen an already existing gap and force them to set up their own specialized training courses. Several companies (Fairbanks Morse, Beloit Corporation, etc.) have already considered initiating such courses in their plants. This thinking can only be reversed when school officials and program instructors get together with various industrial representatives to discuss and exchange information that is pertinent to each others particular needs.

Mr. M. J. Davis, supervisor of the training program at the Central Electric Company, indicates the need for educational institutions and industry to get together and exchange information with one another by stating:

Since industry is one of the principle customers for the end product of a school system and is vitally interested in the abilities and potential of the product,

it seems only logical that industry should play a leading role in closing that gap.¹

In Rock and Green counties the industries are more than willing to exchange ideas and information with school officials and program instructors of the Blackhawk Technical Institute - District No. Five, Beloit, Wisconsin. It is through this exchange of information that the one-year vocational welding program in this District is continuously being up dated. Yet every year the local industries of Rock and Green counties ask for weldors who are qualified and competent to perform modern welding tasks. It is in the light of these things that the one-year vocational welding program is being up dated.

It is hoped that by up dating the welding program the following goals will be met:

- (1) To educate students as individuals, by considering individual needs and interests as they relate to his or her particular field.
- (2) To be able to prepare the students for gainful employment.
- (3) To be able to provide the opportunities for the up-grading of employees.
- (4) To be able to provide the students with skills for improving and up-grading their employment opportunities.
- (5) To recruit and motivate people to enroll in the welding program.
- (6) To develop in students an acceptable work attitude towards the welding field.

¹M. J. Davis "Closing the Education-Industry Interface Gap," Technical Educational News, (January - February 1970), P. 7.

- (7) To enrich a student's knowledge and skill in a chosen field of welding.
- (8) To provide a welding program which will be available to all interested members of the community.
- (9) To motivate students to extend themselves in their trade through independent research and/or study.
- (10) To prove to students that they have an important place in life, one with dignity, status and prestige in a job requiring an education of less than a baccalaureate degree.

To help improve public relations between the school and community, the welding program, if it is to attain the above goals, must employ those skills and competencies industry claims are essential for all weldors to possess. Thus, the purpose of this study is to survey the local welding industries in Rock and Green counties to determine the professional ratings of the tasks a beginning weldor must be able to perform for employment. It is also intended that this study will give realistic opinions and suggestions on equipment and tools required for employment along with industrial trends and hiring policies.

CHAPTER II

PROCEDURES AND METHODS

Population And Sample

Population Support¹ (Type of Community Students Come From)

Before this study was undertaken it was felt that the people involved, in order to aid them in their task, should have a working knowledge of the area Blackhawk Tech serves. Therefore, the following statistical information was obtained: (1) geographic description and need of the area; (2) socio - economic and educational need of the area; and (3) educational facilities needs.

Geographic description and need of the area. Blackhawk Tech is located in Southern Wisconsin. Its Southern border is the Illinois - Wisconsin state line.² It is comprised of Green County less the portion of the New Glarus, Blanchardville, Belleville, and Oregon school districts and Rock County less the portion of the Oregon and Stoughton school districts which are in these two counties.³ The Blackhawk Tech District is approximately half way between the east and west boundaries of Wisconsin and the northern bound-

¹The information contained in the following paragraphs and relating to "Population Support" was obtained from a mimeographed paper put out by the Blackhawk Tech Institute.

²See Appendix B. p. 76.

³See Appendix C. p. 79.

boundary lies about twenty miles from Madison. Milwaukee is sixty miles east, Chicago is ninety miles southeast and Rockford is fifteen miles south of the district boundaries.⁴ Approximately 1,307 square miles or 688,600 acres make up the Blackhawk Tech District and for the most part, this land area is fertile, high value agricultural land devoted to dairy, corn, beef, hogs, and cash crops. Numerous industries are located in the area with the largest being in the Janesville-Beloit area. Janesville has a large General Motors assembly division, the Parker Pen Company and Gilman Manufacturing, plus many smaller employers. The Beloit area has more heavy industry with Fairbanks Morse and the Beloit Corporation leading the way with numerous other industries supplying jobs and a sound tax base for the area.

Socio-economic and educational needs.

1. Population

The population base for Blackhawk Tech is approximately 162,000 in 1970. This figure is derived from the totals for Rock and Green Counties less about 2,000 persons who live in those school district areas attached to another district. This figure compares with a 1960 population figure of 138,000 and a projected 1980 figure of 200,000 persons. This latter figure may be slightly high in light of the present birth rate trends and migration statistics.

⁴ See Appendix B. p. 77.

2. Education

School enrollment in the Blackhawk Tech District is nearly 40,000 K-12 students. High school graduations occur at the rate of 2,500 per year with these increasing to 2,800 per year by 1980. Of the 2,500 students graduating each year from local high schools, approximately 65% or 1,625 individuals do not continue their education at a four year institution. Only about 12% of the high school graduates are being served by District Five at the present. This figure is expected to increase to at least 20% in the next ten years. In addition, greatly increased numbers of returning veterans and young adults who have been out of school several years are expected to return for full time education as new programs of high quality are developed and made available to Blackhawk Tech District residents.

3. Ethnic Background

Blackhawk Tech's population includes many ethnic backgrounds with the largest concentrations from Germany, Norway, Switzerland, United Kingdom, Sweden, Italy, and Denmark. The non-white population is approximately 3,500 concentrated in the Beloit area. About 5.25% of the labor force in Beloit is non-white.

4. Poverty

Poverty is found in all major groups of population in the Blackhawk Tech District, but it is most concentrated in the under-educated, the aged, and the non-white. Geographically, poverty is concentrated in rural areas and in

the non-white community. Nearly 4,000 families in the Blackhawk Tech District have less than \$3,000 incomes. Blackhawk Tech, as a whole though, is not poverty stricken. It has the second highest ability to pay of any of the eighteen districts in Wisconsin. This is determined by dividing the population into the assessed equalized valuation to come up with a per capita net worth figure. Although poverty exists, Blackhawk Tech has the economic resources to cope with this, especially in terms of offering educational opportunity to all individuals.

5. Employment

The employment opportunities in the Blackhawk Tech District are many, although at the present time (1971) unemployment rates are similar to the national averages which are considered to be high. This general slowing down of the economy is not considered serious in this community, but certainly it is a consideration for Blackhawk Tech to evaluate as it plans programs to serve people. In 1960 there were 1,163 employers participating in unemployment compensation while in 1970 this figure was 1,521. The total employers employing one or more employees is approximately 3,000 in the Blackhawk Tech District.

Employment in the area centers around a balanced mix of heavy industrial, light industrial, service workers and agricultural, both farm and non-farm. The balanced employment force contributes to the stability of the economy in the Blackhawk Tech District and points to a need for diversified

educational programs in business, industry, service occupations, and agriculture. The impact of the new technology is reaching every corner of the district with automation taking over unskilled jobs and placing new demands on the worker in terms of job competencies required to stay abreast of change. These needs point to increased involvement of Blackhawk Technical - Vocational - Technical School in the growth of this community.

Educational facilities needs. Blackhawk Tech operates two campuses where certificate, vocational diploma and associate degree programs are offered. Blackhawk Vocational - Technical School is the institution that grants the degree and controls the program to insure that quality education is achieved by each student enrolled.

The campuses are: Blackhawk Tech
Janesville Campus
527 South Franklin Street
Janesville, Wisconsin 53545

Blackhawk Tech
Beloit Campus
1149 4th Street
Beloit, Wisconsin 53511

In addition, Blackhawk Tech operates twelve adult education centers through out the two-county area. These centers are located in Juda, Albany, Brodhead, Evansville, Edgerton, Clinton, Monroe, Monticello, Milton, Orfordville, and the Janesville and Beloit Campuses.

The two campuses provide a total of 97,000 square feet of space. Forty-four thousand is in Beloit and 53,000 is at the Janesville Campus. The Janesville Campus includes 19,000

square feet at the airport center for the aviation Maintenance Technician Program. More than 60 classrooms, laboratories, and shops are available for instructional purposes at the two campuses. Each campus has a library, student lounge, staff lounge, teacher prep room, and an administrative office. Adequate street and off-street parking is available at both campuses for present enrollments.

The future growth of Blackhawk Tech's full-time programs will necessitate the addition of approximately 12,000 square feet of space per year for the next ten years in order to meet the demands for new programs and increased student enrollment. To compensate for increased enrollment, a new school is presently (1974) under construction and should be completed sometime in mid 1976.⁵

Sample

Because of the wide variety of questions needing answering and the many different kinds of learning activities (competencies and skills) involved in meeting student's needs, it was necessary to select from the population (service area of Blackhawk Tech) all or most of the major companies doing welding. Sixty-nine of ninety-one companies in the area, known to do welding, were asked to participate in the study.⁶ The firms not asked to participate were (1) privately owned (one man) welding shops, (2) contractors

⁵See Appendix C. pp. 79 - 81.

⁶See Appendix D. pp. 83 - 86.

hiring union help only, and (3) automobile service stations and garages. The companies asked to participate fell into one or more of the following categories: (1) companies hiring weldors, (2) companies not hiring weldors, (3) companies hiring inexperienced weldors, (4) companies not hiring inexperienced weldors, and (5) companies hiring inexperienced weldors only when experienced weldors are not available in the job market. The only companies asked to participate in the study were those located in the Blackhawk Technical Institute District.

Instrument Design

To assure that the survey instrument (forms) would be functional and have high content validity the following steps and/or procedures were followed: (1) a rough draft of the survey instruments was developed, (2) the rough draft was pre-piloted, (3) the rough draft was revised, (4) the revised draft was pre-piloted, and (5) a final draft was drawn-up and approved by the Welding Advisory Committee members of Blackhawk Tech.

Rough Draft of Survey Instruments (Forms) Developed

June - August (1972) - A rough draft of the survey instruments was developed in a course titled "Instrumentations For Research." The course was offered at the University of Wisconsin - Stout, Menomonie, Wisconsin. The survey (task analysis - schedule) was titled, "A Welding Survey Of The Blackhawk Technical Institute Industries - (Up-Dating The

Welding Curriculum)." The rough draft consisted of the following: (1) Title Page, (2) List of Objectives, (3) Rationale, (4) Definition of Terms, (5) Employment Trends, (6) Tools and Equipment, (7) Welding Processes, and (8) Welding Tasks.⁷

Rough Draft Pre-Piloted

June - August (1973) - To be certain that the instrument would be functional and have high content validity the rough draft was pre-piloted to several University of Wisconsin - Stout faculty and supervisory committee members and to several welding firms in Southern Wisconsin and Northern Illinois. The following is a list of those people and/or companies:

1. Faculty Members (Stout)

- Richard Gebhart
- Robert Rudiger
- James Benson
- John Entorf
- Arthur Mueller
- Richard Klatt

2. Supervisory Committee Members (Stout)

- Orville Nelson (Chairman)
- Harold Halfin
- John Entorf

3. Companies in Southern Wisconsin and Northern Illinois

- Colt Industries,
Beloit, Wisconsin
- Knight Manufacturing Companies
Brodhead, Wisconsin

⁷See Appendix E. pp. 88 - 89.

- Electrode Specialists, Incorporated
South Beloit, Illinois
- Precision Fabricators, Incorporated
South Beloit, Illinois

Rough Draft Revised⁸

August (1973) - The first draft was revised using the recommendations obtained from the pre-pilot group. The following describes some of the revisions made:

(Survey Instruments)

1. Definition of Terms (See pages 92 and 106)

The description of the welding terms on the unrevised form were changed to the standard definitions used by the American Welding Society.

2. Objectives (See pages 89 and 105)

The page of objectives, in the unrevised form, was replaced with a table of specification. The table identifies the four survey instruments (Employment Information, Tools and Equipment, Welding Processes, and Welding Tasks) in terms of stated objectives, and gives the section number along with the number of items each respondent will need to answer.

3. Section I - Employment Information (See pages 93 - 94 and 107 - 108)

Question number 9, 10, 11, 12, 16, 18, and 19 of the unrevised form have been reworded.⁹ Question 14

⁸See Appendix F. pp. 101 - 113.

⁹These questions are numbered differently on the revised form.

and 17 have been omitted

4. Section II - Tools and Equipment (See pages 95 and 109)

A second rating column was added to the revised forms and was given the title "Set-up Weldor." The original column on the form was given the title "Weldors." Several different tools were added and omitted from the existing list.

5. Section III - Welding Processes (See pages 96 and 110)

A standard abbreviation for each of the processes listed on the revised form was inserted, in parenthesis, after all but one of the items.¹⁰ Changes were made in the importance ratings column and a frequency column was added for clarification purposes.

6. Section IV - Welding Tasks (See pages 97 - 99 and 111 - 113)

Tasks 11, 12, 28, 29, 59, 69, 71, 72, and 80 were reworded. Tasks 53, 74, 81, 82, 83, and 84 were added to the revised form while task 78 was omitted. The importance rating column was clarified by inserting after it various statements concerning supervision.

Revised Draft Pre-Piloted

November (1973) - Welding Advisory Committee meeting¹¹ was held at Blackhawk Tech and copies of the revised survey

¹⁰ No known abbreviation was found for this item.

¹¹ See Appendix G. pp. 115 - 118.

draft were issued to each of the committee members. The members were given an explanation concerning their role in the study and were told that they would have the final say as to how the forms would appear in the finished or final draft. The members were given until the next meeting to review the forms and make notes concerning any necessary revisions.

Final Draft Drawn-Up And Approved By The Welding Advisory Committee Members Of Blackhawk Technical Institute

January (1974) - A second Welding Advisory Committee meeting¹² was held for the purpose of approving any suggestion and/or recommendations any members may have had which would help clarify statements and improve content validity. The following identifies a few of the changes made:

(Survey Forms - Final Draft)¹³

1. Section I - Employment Information (See pages 107 - 108 and 126 - 127)

Question number 4 was divided into two separate items. On the final draft they appear as items 4 and 5. Question number 8 had another response item added to it and appears as number 9 in the final draft.

2. Section II - Tools and Equipment (See pages 109 - and 128)

The committee felt "Soap Stone" should be added to the list.

¹²See Appendix H. pp. 120 - 121.

¹³See Appendix I. pp. 123 - 132.

3. Section III - Welding Processes (See pages 110 and 129)

The committee felt this section was okay.

4. Section IV - Welding Tasks (See pages 111 - 113 and 130 - 132)

Question number 6 was omitted and replaced with another task called "Peen Straightening."

Procedure Used In Data Collection

Company Addresses

After the Welding Advisory Committee members approved the final survey draft, a list of the companies known to do welding in the Blackhawk Technical Institute District was completed.¹⁴ The list consisted of (1) company names, (2) addresses, and (3) zip codes.

Forward Letter and Return Post Card¹⁵

A letter announcing the research project, along with a return pre-stamped post card, was mailed to all of the companies the Welding Advisory Committee members felt should participate. The letters were printed on school letter head and were approved and signed by Orvis L. Johnson, District Director. Letters were sent to sixty-nine welding establishments in the District. Table I gives the number and percent of respondents returning the enclosed post card indicating their desire to participate in the study. Twenty-five

¹⁴See Appendix D. pp. 83 - 86.

¹⁵See Appendix J. pp. 134 - 135.

(36.2%) of the companies returned post cards. All of the twenty-five companies returning post cards indicated they would participate in the survey.¹⁶

TABLE I
NUMBER AND PERCENT OF COMPANIES RETURNING
POST CARDS AND WISHING TO PARTICIPATE
IN THE SURVEY

Number Sent	Number Returned Marked "Yes"	Percent ^a
69	25 ^b	36
Total Percentage Returned		36%

^aPercent rounded off to the nearest whole number

^bThis number also represents the total number of returns.

Follow-Up

Three weeks after the forward letters were mailed a follow-up of the non-respondents was conducted using the telephone method. An explanation concerning their role in the study was presented. As a result of these phone calls, twenty-eight of the forty-four non-respondents decided to participate.¹⁷ Table II indicates the total number and percent of companies wishing to participate.

¹⁶ See Appendix K. pp. 137 - 138.

¹⁷ See Appendix L. pp. 140 - 142.

TABLE II
TOTAL NUMBER AND PERCENT OF COMPANIES
WISHING TO PARTICIPATE IN SURVEY

Total Number of Companies Contacted	Total Number of Companies Wishing to Participate	Percent ^a
69	53	77
Total Percentage Wishing to Participate		77%

^aPercent rounded off to the nearest whole number

Appointments

All of the respondents wishing to participate in the project were contacted by telephone and appointments for administering the survey, on a personal interview basis, were scheduled. Three of the interviews were scheduled to be held at Blackhawk Technical Institute while all the others were arranged to be held at the respondents' place of business.

Interview Schedule

The interviewing process took place during the months of March, April, May, and June of 1974. Most of the appointments were scheduled to be held after 3:30 P. M. on Monday's, Tuesday's, Thursday's and Friday's. Three of the interviews were scheduled for Saturday mornings.

Miles Traveled And Gasoline Consumed

After completing the interviews a total of 1,335 miles had been traveled and approximately 95 gallons of gasoline were consumed.

CHAPTER III

DATA ANALYSIS (RESULTS)

Companies Interviewed

Table III indicates that of the fifty-three companies wishing to participate in the study only 43 (81%) were interviewed.¹

Report of Results

In order to report the content of the survey returns more completely, a number of tables concerned with each of the four sections (Employment Information, Tools and Equipment, Welding Processes, and Welding Tasks) have been devised. The tables were arranged according to the items in each section of the survey schedule.

Employment Information

Table IV gives the number and percent of companies having minimum formal education requirements for hiring inexperienced beginning weldors. The table indicates that only 1 (4.35%) of the twenty-three companies hiring inexperienced weldors required some kind of formal education, while, 21 (91.3%) did not. One (4.35%) respondent, depending upon the type of weldor employed (experienced or inexperienced) and the types of jobs performed, stated that his company did not

¹See Appendix M. pp. 144 - 147.

TABLE III
NUMBER AND PERCENT OF COMPANIES
INTERVIEWED

Number of Companies Wishing to be Interviewed	Number of Companies Interviewed	Percent ^a
53	43 ^b	81
Total Percentage Interviewed		81%

^aPercent rounded off the the nearest whole number.

^bThis number is smaller than fifty-three because the energy crisis, union strikes, and increased production forced ten potential companies to cancel scheduled interviews.

TABLE IV
NUMBER AND PERCENT OF COMPANIES HAVING MINIMUM
FORMAL EDUCATION REQUIREMENTS FOR HIRING
INEXPERIENCED WELDORS

(N = 23)^a

Type of Company	Number of Companies	Percent ^b
Companies Requiring A Formal Education	1 ^c	4.35
Companies Not Requiring A Formal Education	21 ^d	91.30
Companies Having Both	1	4.35
Totals	23	100.00%

^aOnly companies hiring inexperienced weldors are summarized in this table.

^bPercent rounded off to the second decimal place

^cThis company required its weldors to have a high school diploma plus some vocational training in their field.

^dMost of the respondents from these companies, during the author's interviews, stated that they did not have formal education requirements per se - since nothing concerning education was written into their hiring policies.

always require their weldors to have a formal education. It should be noted that most of the respondents, during the author's interviews, stated that they did not have any educational requirements per se - since nothing concerning education has been written into their hiring policies and/or contracts. The one company that required a formal type of education stated that its beginning weldors, before being employed, had to have a high school diploma plus some vocational training in their field.

Table V gives the number and percent of companies hiring and not hiring weldors. The table indicates that of the forty-three companies interviewed 27 (63%) hired weldors, while, 16 (37%) did not. The firms not hiring weldors have other employees (operating engineers, mechanics, maintenance personnel, iron workers, steel workers, machine shop operators, and electricians) doing the required welding in their plants.

Table VI indicates the number and percent of companies hiring inexperienced and experienced weldors. This table shows that 23 (54%) of the companies interviewed hired inexperienced weldors, and 4 (9%) hired inexperienced weldors only when experienced weldors were not available in the job market. When inexperienced weldors were hired by the four companies mentioned above, a certain amount of on-the-job training was required. Table VII summarizes the average plant hours the companies hiring inexperienced weldors spent in on-the-job training of beginning weldors. The table indicates that an average of 233 hours of on-the-job training

TABLE V
NUMBER AND PERCENT OF COMPANIES
HIRING AND NOT HIRING
WELDORS

(N = 43)

Type of Company	Number of Companies	Percent ^a
Companies Hiring Weldors	27	63
Companies Not Hiring Weldors ^b	16	37
Totals	43	100%

^aPercent rounded off to the nearest whole number.

^bThese companies have workers other than weldors doing the welding in their plants.

TABLE VI
NUMBER AND PERCENT OF COMPANIES
HIRING EXPERIENCED AND
INEXPERIENCED
WELDORS

(N = 43)

Type of Company	Number of Companies	Percent ^a
Companies Hiring Inexperienced Weldors	23	54
Companies Not Hiring Inexperienced Weldors	16	37
Others ^b	4	9
Totals	43	100%

^aPercent rounded off to the nearest whole number.

^bThese companies hire inexperienced weldors when experienced weldors are not available.

TABLE VII
AVERAGE COMPANY HOURS SPENT IN ON-THE-JOB
TRAINING OF INEXPERIENCED WELDORS

(N = 21)

Type of Company	Number of Companies	Training Hours (Mean) ^a	Standard Deviation ^b
Companies Hiring Weldors (N = 27)	17	233	371
Companies Not Hiring Weldors ^c (N = 16)	4	126	205
Companies Hiring Inexperienced Weldors (N = 23)	19	220	365
Companies Not Hiring Inexperienced Weldors (N = 16)	0 ^e	0	0
Others ^d	2	140	20

^aMean rounded off to the nearest whole number

^bStandard deviation rounded off to the nearest whole number

^cThese companies have other employees doing the welding

^dThese companies hire inexperienced weldors when experienced weldors are not available

^eThese companies were not asked to respond to the question

were required by the seventeen companies hiring weldors; while at the same time, 126 hours of training were required by the four companies not hiring weldors. Compared to the nineteen companies hiring inexperienced weldors 220 hours of on-the-job training were required; whereas, 140 hours were required for the two companies that hired inexperienced weldors when experienced workers were not available.

The companies hiring experienced weldors were not asked to respond to the question. A total of twenty-one companies responded to the item. Four companies hiring inexperienced weldors omitted the question.

The standard deviations are high because of the huge number of hours some of the respondents felt were necessary for training their weldors. For instance, several respondents felt 8000 hours were required to train beginning weldors in their plants.²

Table VIII presents a summary of the qualifications the companies hiring experienced weldors feel inexperienced weldors should have before being hired. In summary, the two qualifications most often listed were: (1) prior experience in welding - all positions using SMAW and GMAW processes;³ and (2) prior experience in basic metallurgy and blueprint reading. Other qualifications were listed, the reader is asked to study the table and draw personal conclusions

²Eight thousand hours is equal to a four year apprenticeship program in welding.

³See Appendix I. p. 125.

TABLE VIII

QUALIFICATIONS INEXPERIENCED WELDORS SHOULD
POSSESS BEFORE BEING EMPLOYED
BY THOSE COMPANIES HIRING
EXPERIENCED WELDORS

(N = 16)

Qualifications	Number of Companies	Percent
The beginning weldor should:		
1. have some prior experience in welding (know SMAW and GMAW welding processes).	3	18.8
2. have prior experience in blue-print reading and metallurgy.	3	18.8
3. have a basic mechanical aptitude, knowledge, and interest in the welding field.	2	12.5
4. have an iron worker, carpenter, or operating engineer apprenticeship certificate.	2	12.5
5. have prior experience in out-of-position welding, mechanics, and steel fabrication.	2	12.5
6. have some prior experience in electrical shop wiring.	1	6.3
7. be certified in welding structural steel and have a knowledge of machine shop maintenance and electrical shop wiring.	1	6.3
8. have a sheet metal apprenticeship certificate.	1	6.3
9. have vocational training in welding plus a good attitude toward welding.	1	6.3
Totals	16	100% ^a

^aPercent rounded off to nearest whole number.

concerning the priority ratings for the remaining items.

Table IX summarizes, in number and percent, the respondents' feelings concerning the five year employment trend for hiring weldors. The respondents, on the survey form, were asked to respond to four statements: (1) Increase, (2) Stay the Same, (3) Decrease, and (4) Impossible To Tell.

The table indicates that of the twenty-seven companies hiring weldors 19 (70.4%) believed it would increase, 5 (18.5%) thought it would stay the same, 1 (3.7%) felt it would decrease, and 2 (7.4%) said it was impossible to tell; while, the sixteen companies not hiring weldors 4 (25.0%) believed it would increase, 8 (50.0%) thought it would stay the same, 1 (6.2%) felt it would decrease, and 3 (18.8%) said it was impossible to tell. Compared to the twenty-three companies hiring inexperienced weldors 15 (65.2%) believed it would increase, 5 (21.8%) thought it would stay the same, 0 (0.0%) felt it would decrease, and 3 (13.0%) said it was impossible to tell; whereas, sixteen companies hiring experienced 6 (37.5%) thought it would increase, 6 (37.5%) felt it would stay the same, 2 (12.5%) believed it would decrease, and 2 (12.5%) said it was impossible to tell.

The four companies that hired inexperienced weldors when experienced weldors were not available had mixed opinions concerning the trend. Two (50.0%) believed it would increase and 2 (50.0%) thought it would stay the same.

In summary, of the forty-three companies interviewed 23 (53.5%) believed the employment of weldors in their plants

TABLE IX
FIVE YEAR EMPLOYMENT TREND FOR
HIRING WELDORS - 1974 - 79

(N = 43)

Five Year Trend	Companies Hiring Weldors		Companies Not Hiring Weldors ^a		TOTAL		Companies Hiring Inexperienced Weldors		Companies Hiring Experienced Weldors		Others ^b	
	N = 27		N = 16		N = 43		N = 23		N = 16		N = 4	
	N	% ^c	N	%	N	%	N	%	N	%	N	%
Increase	19	70.4	4	25.0	23	53.5	15	65.2	6	37.5	2	50.0
Stay The Same	5	18.5	8	50.0	13	30.2	5	21.8	6	37.5	2	50.0
Decrease	1	3.7	1	6.2	2	4.7	0	0.0	2	12.5	0	0.0
Impossible To Tell	2	7.4	3	18.8	5	11.6	3	13.0	2	12.5	0	0.0
Totals ^d	27	100.0%	16	100.0%	43	100.0%	23	100.0	16	100.0%	4	100.0%

^aThese companies have other workers in their plant doing the welding.

^bThese companies hire inexperienced weldors when experienced weldors are not available.

^cPercent rounded off to one decimal place.

^dPercent (total) rounded off to the nearest whole number.

in the next five years would increase, 13 (30.2%) thought it would stay the same, 2 (4.7%) felt it would decrease, and 5 (11.6%) said it was impossible to tell.

Although some companies were unable to tell the five year employment trend for the hiring of weldors, they were able to comment on whether or not their companies would hire weldors next year - 1975. Table X summarizes the number and percent of companies that indicated they would or would not hire weldors in 1975. The table indicates that of the twenty-seven companies hiring weldors 18 (66.6%) stated they would hire weldors next year and 9 (33.3%) said they would not; while, the sixteen companies hiring workers other than weldors to do the welding, 1 (6.2%) stated they will and 13 (81.3%) said they would not. One (6.2%) of the companies said it depends upon the labor market and/or energy crisis and 1 (6.2%) did not respond to the question. Compared to the twenty-three companies hiring inexperienced weldors 13 (56.5%) stated they would not; whereas, of the sixteen companies hiring experienced weldors 4 (25.0%) indicated they would and 10 (62.5%) said they would not. One (6.2%) of the companies said it depends upon the energy crisis and 1 (6.2%) did not respond to the item.

In summary, of the forty-three companies interviewed 19 (44.1%) stated they would hire weldors next year - (1975), 22 (51.1%) felt they would not, 1 (2.3%) said it depends upon the labor market and/or energy crisis, and 1 (2.3%) did not respond to the question.

TABLE I
NUMBER AND PERCENT OF COMPANIES THAT
WILL AND WILL NOT HIRE WELDORS
IN 1975

(N = 43)

One Year Trend (1975)	Companies Hiring Weldors N = 27		Companies Not Hiring Weldors ^a N = 16		TOTAL N = 43		Companies Hiring Inexperienced Weldors N = 23		Companies Hiring Experienced Weldors N = 16		Others ^b	
	N	% ^c	N	%	N	%	N	%	N	%	N	%
Companies Indicating They Will Hire Weldors	18	66.6	1	6.2	19	44.1	13	56.5	4	25.0	2	50.0
Companies Indicating They Will Not Hire Weldors	9	33.3	13	81.3	22	51.1	10	43.5	10	62.5	2	50.0
Companies Having Comments ^d	0	0.0	1	6.2	1	2.3	0	0.0	1	6.2	0	0.0
Companies Not Responding To Item	0	0.0	1	6.2	1	2.3	0	0.0	1	6.2	0	0.0
Total ^e	27	100.0%	16	100.0%	43	100.0%	23	100.0%	16	100.0%	4	100.0%

^aThese companies have other workers in their plants doing the welding.

^bThese companies hire inexperienced weldors when experienced weldors are not available.

^cPercent rounded off to one decimal place.

^dThese companies said it depends upon the labor market and energy crisis.

^ePercent (total) rounded off to the nearest whole number.

Many of the companies hiring weldors, both next year and in five years from now, stated that they would be willing to employ one-year vocationally trained weldors. Table XI summarizes the number and percent of companies willing to hire one-year vocationally trained weldors. The table indicates that of the twenty-seven companies hiring weldors 23 (85.2%) stated they would hire such weldors, 3 (11.1%) felt they would not, and 1 (3.7%) said it depends upon whether or not the weldor has had prior training in machine shop maintenance and/or electrical shop wiring; at the same time, of the sixteen companies not hiring weldors 8 (50.0%) stated they would, 5 (31.3%) felt they would not, 2 (15.5%) said it depends upon whether or not the weldor has had training in machine shop maintenance, and 1 (6.2%) company omitted the question. Compared to the twenty-three companies hiring inexperienced weldors 17 (73.9%) stated they would hire vocational weldors, 4 (17.4%) felt they would not, and 2 (8.7%) said they would if the weldors had prior training in machine shop maintenance and/or electrical shop wiring; whereas, of the sixteen companies hiring experienced weldors, 11 (68.8%) thought they would, 3 (18.8%) felt not, 1 (6.2%) said it depends upon the weldor's training in other fields, such as machine shop and electrical shop wiring, and 1 (6.2%) company omitted the item.

In summary, of the forty-three weldors interviewed 31 (72.1%) stated they would hire vocationally trained weldors, 8 (18.6%) felt they would not, 3 (7.0%) said it depends upon

TABLE XI

NUMBER AND PERCENT OF COMPANIES WILLING
TO HIRE ONE YEAR VOCATIONALLY
TRAINED WELDORS

(N = 43)

Type of Company	Companies Hiring Weldors (N = 27)		Companies Not Hiring Weldors ^a (N = 16)		TOTAL		Companies Hiring Inexperienced Weldors (N = 23)		Companies Hiring Experienced Weldors (N = 16)		Others ^b (N = 4)	
	N	% ^c	N	%	N	%	N	%	N	%	N	%
Companies Willing To Hire Vocationally Trained Weldors	23	85.2	8	50.0	31	72.1	17	73.9	11	68.8	3	75.0
Companies Not Willing To Hire Vocationally Trained Weldors	3	11.1	5	31.3	8	18.6	4	17.4	3	18.8	1	25.0
Companies Having Comments ^d	1	3.7	2	12.5	3	7.0	2	8.7	1	6.2	0	0.0
Companies Not Responding To Question	0	0.0	1	6.2	1	2.3	0	0.0	1	6.2	0	0.0
Totals ^e	27	100.0%	43	100.0%	43	100.0%	23	100.0%	16	100.0%	4	100.0%

^aThese companies have other employees in their plants doing the welding.

^bThese companies hire inexperienced weldors when experienced weldors are not available.

^cPercent rounded off to one decimal place.

^dThese companies will hire vocationally trained weldors if they have a background in machine shop maintenance and/or electrical shop wiring.

^ePercent (total) rounded off to the first decimal place.

whether or not the weldors have experience or past training in machine shop maintenance and/or electrical shop wiring, and 1 (2.3%) of the companies did not respond to the item.

Table XII summarizes the number and percent of companies having testing and licensing facilities for certifying weldors. The table indicates that of the twenty-seven companies hiring weldors 5 (18.5%) had their own testing and licensing facilities, 22 (81.5%) did not; while, sixteen companies not hiring weldors 1 (6.2%) has facilities and 15 (93.8%) did not. Compared to the twenty-three companies hiring inexperienced weldors 2 (8.7%) have and 21 (91.3%) have not; whereas, sixteen companies hiring inexperienced weldors when experienced weldors are not available, 1 (25.0%) has its own facilities and 3 (75.0%) do not.

In summary, of the forty-three companies interviewed 6 (14.0%) have facilities for testing and licensing weldors; while, 37 (86.0%) companies did not.

Table XIII summarizes the number and percent of companies requiring weldors to be certified. The table indicates that of the twenty-seven companies hiring weldors 2 (7.4%) required weldors to be certified, 24 (88.8%) did not, 1 (3.7%) said they did - but for special jobs only; while, of sixteen companies not hiring weldors per se⁴ 2 (12.5%) required certification, and 14 (87.5%) did not. Compared to the twenty-three companies hiring inexperienced weldors

⁴These companies have workers other than weldors doing the welding in their plants.

TABLE XII
NUMBER AND PERCENT OF COMPANIES HAVING
TESTING AND LICENSING FACILITIES
FOR CERTIFYING WELDORS

(N = 43)

Type of Company	Companies Hiring Weldors		Companies Not Hiring Weldors ^a		TOTAL		Companies Hiring Inexperienced Weldors		Companies Hiring Experienced Weldors		Others ^b	
	(N = 27)		(N = 16)		(N = 43)		(N = 23)		(N = 16)		(N = 4)	
	N	% ^c	N	%	N	%	N	%	N	%	N	%
Companies Having Facilities	5	18.5	1	6.2	6	14.0	2	8.7	3	18.7	1	25.0
Companies Not Having Facilities ^d	22	81.5	15	93.8	37	86.0	21	91.3	13	81.3	3	75.0
Totals ^e	27	100.0%	16	100.0%	43	100.0%	23	100.0%	16	100.0%	4	100.0%

^aThese companies have workers other than weldors doing the welding in their plants.

^bThese companies hire inexperienced weldors when experienced weldors are not available.

^cPercent rounded off to one decimal place.

^dSome of these companies would send their weldors to Madison for testing and licensing.

^ePercent (total) rounded off to the nearest whole number.

TABLE XIII
NUMBER AND PERCENT OF COMPANIES
REQUIRING WELDORS TO
BE CERTIFIED

(N = 43)

Welder Certification Requirements	Companies Hiring Weldors (N = 27)		Companies Not Hiring Weldors ^a (N = 16)		Total (N = 43)		Companies Hiring Inexperienced Weldors (N = 23)		Companies Hiring Experienced Weldors (N = 16)		Others ^b (N = 4)	
	N	% ^c	N	%	N	%	N	%	N	%	N	%
Companies Requiring Certification	5	7.4	2	12.5	4	9.3	2	8.7	2	12.5	0	0.0
Companies Not Requiring Certification	24	88.8	14	87.5	38	88.3	21	91.3	13	81.3	4	100.0
Companies Having Comments ^d	1	3.8	0	0.0	1	2.3	0	0.0	1	6.2	0	0.0
Totals ^e	27	100.0%	16	100.0%	43	100.0%	23	100.0%	16	100.0%	4	100.0%

^aThese companies have workers other than weldors doing the welding in their plants.

^bThese companies hire inexperienced weldors when experienced weldors are not available.

^cPercent rounded off to one decimal place.

^dThese companies require weldors to be certified for special jobs only.

^ePercent (total) rounded off to the nearest whole number.

2 (8.7%) required licensing, 21 (91.3%) did not; whereas, of the sixteen companies hiring experienced weldors 2 (12.5%) required licensing, 13 (81.3%) did not, and 1 (6.2%) said they did - but for special jobs only. The four companies that hired inexperienced weldors when experienced workers were not available said they did not require weldors to be licensed.

In summary, of the forty-three companies interviewed 4 (9.3%) required their weldors to be certified (licensed), 38 (88.3%) did not, and 1 (2.3%) said it did - but for special jobs only.

Most of the certified weldors, in the companies requiring certification, possessed American Welding Society licenses as shown in Table XIV. The table, in summary, indicates that of the forty-three companies interviewed, 10 (23.2%) required their weldors to be certified, and of those ten companies 4 (9.3%) required the American Welding (AWS) license, 3 (6.98%) the Society of Automotive Engineer (SAE), 1 (2.3%) the United States Navy (USN), and 2 (4.7%) other licenses.⁵

Table XV summarizes the average number of weldors employed in the forty-three companies interviewed. The table indicates that an average of 13.6 weldors, or workers doing welding but not called weldors, were hired by twenty-seven companies hiring weldors, 5.4 by sixteen companies not hiring

⁵United States Coast Guard and American Bureau of Ship licenses.

TABLE XIV

TYPES OF LICENSED CERTIFICATES
COMPANIES REQUIRE WELDORS
TO POSSESS

Type of Certification	Companies Hiring Weldors		Companies Not Hiring Weldors ^a		TOTAL		Companies Hiring Inexperienced Weldors		Companies Not Hiring Inexperienced Weldors		Others ^b	
	N = 27		N = 16		N = 43		N = 23		N = 16		N = 4	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	N/% ^c		N/%		N/%		N/%		N/%		N/%	
United States Navy (USN)	1/3.7%	26/96.3%	0/0.0%	16/100.0%	1/2.3%	42/97.7%	0/0.0%	23/100.0%	1/6.3%	15/93.7%	0/0.0%	4/100.0%
American Society of Mechanical Engineers	3/11.1%	24/88.9%	0/0.0%	16/100.0%	3/6.9%	40/93.0%	1/4.3%	22/95.6%	1/6.3%	15/93.7%	1/25.0%	3/75.0%
American Welding Society	2/7.4%	25/92.6%	2/12.5%	14/87.5%	4/9.3%	39/90.7%	1/4.3%	22/95.7%	3/18.8%	13/81.3%	0/0.0%	4/100.0%
Society of Automotive Engineers	0/0.0%	27/100.0%	0/0.0%	16/100.0%	0/0.0%	43/100.0%	0/0.0%	23/100.0%	0/0.0%	16/100.0%	0/0.0%	4/100.0%
American Society of Testing Materials	0/0.0%	27/100.0%	0/0.0%	16/100.0%	0/0.0%	43/100.0%	0/0.0%	23/100.0%	0/0.0%	16/100.0%	0/0.0%	4/100.0%
Others ^d	2/7.4%	25/92.6%	0/0.0%	16/100.0%	2/4.7%	41/95.3%	1/4.3%	22/95.7%	0/0.0%	16/100.0%	1/25.0%	3/75.0%

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^aThese companies have employees other than weldors doing the welding in their plants.^bThese companies hire inexperienced weldors when experienced weldors are not available.^cPercent rounded off to one decimal place.^dUnited States Coast Guard and American Bureau of Ships (ABS).

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TABLE XV
AVERAGE NUMBER OF WELDORS EMPLOYED
IN THE WELDING COMPANIES

(N = 43)

Type of Company	Number of Companies Responding	Average ^a Number of Weldors	Standard Deviation ^b
Companies Hiring Weldors (N = 27)	27	13.6	17.6
Companies Not Hiring Weldors ^c (N = 16)	15 ^d	5.4	3.4
Companies Hiring Inexperienced Weldors (N = 23)	22 ^d	10.6	14.5
Companies Hiring Experienced Weldors (N = 16)	16	12.1	16.6
Others ^e (N = 4)	4	5.0	2.7

^aMean rounded off to one decimal place.

^bStandard deviation rounded off to one decimal place.

^cThese companies have other employees in their plant doing the welding.

^dOne respondent did not respond to the question.

^eThese companies hire inexperienced weldors when experienced weldors are not available.

weldors, 10.6 by companies hiring inexperienced weldors, 12.1 by companies hiring experienced weldors, and 5.0 by four companies hiring inexperienced weldors when experienced weldors were not available. One company did not respond to the question. The most weldors in one company were seventy and the fewest was one.

Table XVI summarizes the average hourly wage for beginning weldors. The table indicates that an average of \$3.73 was paid by the twenty-seven companies hiring weldors, \$4.96 by fourteen of sixteen companies not hiring weldors per se, \$3.42 by twenty-two of twenty-three companies hiring inexperienced weldors when experienced weldors were not available. The most money paid any one person (certified) was \$9.87 per hour and the lowest paid any one person (not certified) was \$2.00 per hour. Two of the companies did not respond to the item.

Table XVII summarizes the average number of welding vacancies occurring each year in the companies. The table indicates that of forty-three companies interviewed, 2.6 vacancies occurred in twenty-seven companies hiring weldors, 2.4 in sixteen companies not hiring weldors per se, 1.7 in twenty-three companies hiring inexperienced weldors, 4.1 in companies hiring experienced weldors, and 0.5 in companies that hire inexperienced weldors when experienced weldors are not available. All companies responded to the item.

TABLE XVI
AVERAGE HOURLY WAGE FOR
BEGINNING WELDORS

(N = 43)

Type of Company	Number of Responses ^a	Average Wage (Mean)	Standard Deviation ^b
Companies Hiring Weldors (N = 27)	27	\$3.73	1.01
Companies Not Hiring Weldors ^c (N = 16)	14	\$4.96	2.11
Companies Hiring Inexperienced Weldors (N = 23)	22	\$3.42	0.77
Companies Hiring Experienced Weldors (N = 16)	16	\$5.24	1.99
Others ^d (N = 4)	4	\$4.05	0.74

^aSome of the companies did not respond to the question.

^bStandard deviation rounded off to the nearest whole number.

^cThese companies have other employees in their plant doing the welding.

^dThese companies hire inexperienced weldors when experienced weldors are not available.

TABLE XVII
AVERAGE NUMBER OF WELDING VACANCIES
(PER YEAR) OCCURRING IN
THE COMPANIES

(N = 43)

Type of Company	Number of Responses	No of Vacancies ^a (Mean) ^b	Standard Deviation ^c
Companies Hiring Weldors (N = 27)	27	2.6	4.4
Companies Not Hiring Weldors ^d (N = 16)	16	2.4	8.4
Companies Hiring Inexperienced Weldors (N = 22)	23	1.7	2.9
Companies Hiring Experienced Weldors (N = 16)	16	4.1	9.3
Others ^e (N = 4)	4	0.5	0.5

^aExtremes ranged from 0 - 35 vacancies.

^bMean rounded off to one decimal place.

^cStandard deviation rounded off to one decimal place.

^dThese companies hire workers other than weldors to do the welding.

^eThese companies hire inexperienced weldors when experienced weldors are not available.

Table XVIII summarizes, in number and percent, the welding literature companies feel beginning weldors should read. The respondents, on the survey form, were asked to respond to seven statements: (1) Welding Journal, (2) Welding Engineer, (3) Welding Design And Fabrication, (4) Lincoln's Stabilizer, (5) Welder's Digest, (6) Welding Data Book, and (7) a column titled "Others." Some of the respondents did not respond to the items because they felt they were not familiar enough with the materials listed. The table indicates that of the forty-three companies interviewed 30 (70%) checked Welding Design And Fabrication, 24 (56%) Welder's Digest, 18 (42%) Welding Engineer, 12 (28%) Welding Data Book, 10 (23%) Welding Journal, and 10 (23%) Lincoln's Stabilizer. Many of the respondents checked more than one item. Reading materials listed in the column titled "Others" were: (1) Welder's Handbook, (2) Wisconsin Welding Code Book, (3) Welding Encyclopedia, (4) New lessons In Arc Welding - by Lincoln Manufacturing Company, and (5) Sheet Metal Manuals used by the Apprentices at Blackhawk Technical Institute.

Question Number 19, in Section I (Employment Information)⁶, of the survey schedule was found to be of no value in this study; therefore, it was eliminated from this report.

⁶See Appendix I. p. 127.

TABLE XVIII
PERIODICALS BEGINNING WELDERS
SHOULD READ

(N = 43)

Reading Materials	Number of Respondents Checking Each Item ^a	Percent ^b
Welding Design And Fabrication	30	70
Welder's Digest	24	56
Welding Engineer	18	42
Welding Data Book	12	28
Welding Journal	10	23
Lincoln's Stabilizer	10	23
Other Reading Materials Listed Were:		
Welder's Handbook	1	2
Wisconsin Welding Code Book	1	2
Welding Encyclopedia	1	2
New Lessons In Arc Welding (Lincoln)	1	2
Apprentice Text Book Used At Blackhawk Tech (Welding And Sheet Metal Texts)	1	2

^aMost of the companies checked more than one item.

Tools And Equipment

Section II of the survey schedule⁷ covers tools and equipment. In this section were three vertical columns - the first column gives a list of common tools and/or equipment used by beginning weldors in industry. The second was titled "Weldors,"⁸ and the third was titled "Set-up Weldors."⁹ The second and third columns, four point rating scales, asked the respondents to indicate which tools and/or equipment they felt beginning weldors should purchase before employment, under the following heading: (1) NU - Not Used, (2) N - Nice to Have, (3) E - Essential, and (4) CP - Company Provided.

Table XIX summarizes the responses of the twenty-three industries hiring inexperienced weldors and/or set-up weldors. The table indicates that of the twenty-three companies employing workers to do welding, 20 (87.0%) hired set-up weldors, 3 (13.0%) hired weldors and set-up weldors, and 0 (0.0%) employed only weldors. The table also shows that, the companies as a whole, provided the necessary tools and/or equipment. While some of the tools were rated as "Not Used" or "Nice to Have" many were checked as being "Essential" - meaning the weldors and/or set-up weldors must purchase the

⁷See Appendix I. p. 128.

⁸In this section "Weldor" refers to those workers doing only welding - they do not perform layout or set-up operations.

⁹"Set-up Weldor" refers to those workers doing welding plus set-up work and tacking operations according to blueprints, layouts, work orders, and operating charts.

TOOLS AND/OR EQUIPMENT INDUSTRIES FEELS BEGINNING
(INEXPERIENCED) WELDORS SHOULD
PURCHASE FOR EMPLOYMENT^a

(Section II of Survey Form)

Rating Code:		NU - Not Used N - Nice To Have				E - Essential CP - Company Provided			
Tools and/or Equipment		Weldors ^b N = 3				Set-Up Weldors ^c N = 23			
		NU	N	E	CP	NU	N	E	CP
1. Vise Grips		0	0	1	2	1	1	6	15
2. Two Foot Carpenter Square		2	0	0	1	3	0	2	18
3. Small "C" Clamps (Assorted Sizes)		0	0	0	2	1	0	3	19
4. Level (12" - 36" Length)		2	0	0	1	3	1	2	17
5. Adjustable Wrench (10" or 12")		0	1	2	0	0	2	7	14
6. Chalk Line		2	0	1	0	0	1	3	13
7. Center Punches (Sarge and Small)		2	0	1	0	3	2	6	12
8. Chipping Hammer (Slag)		0	0	2	1	1	0	3	19
9. Combination Steel Square (Set)		2	0	1	0	4	1	7	11
10. Micrometer (0" to 1")		2	0	0	1	7	4	1	11
11. Hammer (16 oz. and/or 40 oz.)		0	0	2	1	0	1	7	15
12. Combination Slip Joint Pliers		0	0	2	1	1	3	7	12
13. Scratch Awl		1	0	1	1	2	1	8	12
14. Steel Scale (Pocket Size - 6")		1	1	0	1	3	2	9	9
15. Trammel Points		2	0	0	1	8	1	3	11
16. Hand Wire Brush		0	0	0	3	0	0	1	22
17. Soap Stone		0	0	0	3	3	1	1	18
18. Safety Leggings		0	1	0	2	12	2	1	8
19. Safety Apron		0	1	0	2	5	7	2	9
20. Safety Gloves		0	0	0	3	0	0	4	18
21. Safety Glasses		0	0	0	3	1	1	1	20
22. Face Shield		0	0	0	3	0	0	0	23
23. Welding Helmet		0	0	1	2	0	0	4	19
24. Welding Lens		0	0	0	3	0	0	2	21
25. Safety Shoes		0	0	1	2	3	4	8	8
26. 10 Foot Steel Tape		0	0	2	1	7	0	6	8
27. 15 Foot Steel Tape		2	0	0	0	10	2	2	3
28. 20 Foot Steel Tape		1	2	0	0	9	1	1	5
29. 50 Foot Steel Tape		2	0	0	1	6	1	1	12
30. Tool Box		0	1	2	1	0	3	13	18
31. Wrenches (Box and/or Open End)		0	0	1	0	0	2	8	10
32. Screw Drivers		0	0	2	0	0	1	10	10

^aThe other types of companies interviewed were found to have similar response patterns.

^bWelder in Section II means: A person who does only welding - No set-up or layout work.

^cSet-up Weldor in Section II means: A person who does set-up and layout work and welds.

supplies themselves. Those tools and/or equipment receiving somewhat high ratings under the "Essential" column were: (1) Tool Box, (2) Screw Driver, (3) Six Inch Steel Scale, (4) Scratch Awl, (5) Safety Shoes, and (6) Box and Open End Wrenches. The items receiving very low ratings were: (1) Face Shield, (2) Fifty Foot Steel Tape, (3) Safety Glasses, (4) Safety Leggings, (5) Soap Stone, (6) Hand Wire Brush, and (7) Micrometer. The other types of industries interviewed were found to have similiar response patterns.

Twenty of the twenty-three industries hiring inexperienced weldors listed other tools and/or equipment beginning weldors might purchase before employment; they are:

1. Six, twelve, sixteen and one-hundred foot steel tapes
2. Padlock
3. Allen wrenches
4. Socket set
5. Side cutting pliers
6. Leather tool belt
7. Tool cart
8. Hand grinder
9. Work bench
10. Six foot carpenter folding ruler
11. Coveralls
12. Cutting torch
13. Torch spark lighter
14. Safety shoulders, jacket and/or arms

For a more detailed description of how the companies responded, the author asks the reader to refer to the table and form his or her own conclusions concerning the importance ranking for each item. It should be noted that during the interviewing procedure many of the respondents stated, verbally, that they would not furnish the employees with small tools if they knew of a good way to get around doing so.

Welding Processes

Section III of the survey form covers welding processes.¹⁰ In this section were three vertical columns - the first column gave a list of the thirteen welding processes most commonly used in the welding firms of the District, the second was titled "Present Use - Importance Rating," and the third was titled "Future Use - Trend Rating." The second column, a five point rating scale, asked the respondents to rate each welding processes in terms of its present use as it relates to the following headings: (1) U - Unimportant - Not Used, (2) MI - Moderately Important - Used Once/Year, (3) I - Important - Used Monthly, (4) VI - Very Important - Used Weekly, and (5) EI - Extremely Important - Used Daily. The third column, also a five point rating scale, asked the respondents to estimate the trend of each process over the next five years (1974 - 1979) with (1) RD - Rapid Decrease, (2) MD - Moderate Decrease, (3) SS - Stay the Same, (4) MI - Moderate Increase, and (5) RI - Rapid Increase.

Decision Rules For Selecting Processes

After the interviewing process was completed and the data analyzed, decisions concerning whether or not to include the various welding processes in the curriculum and the degree of emphasis to be given each had to be made. Several decision rules were drawn-up to aid in the evaluation

¹⁰ See Appendix I. p. 129.

process and are presented in Table XX. The table, based on Q_2 (median) and IQR (inter quartile range), indicates that if a welding process was given an importance rating of 3.00 (Q_2) and more and an IQR of 1.25 and less, with a future trend rating of 3.00 (Q_2) and more and a IQR of 1.25 and less it would be included and emphasized in the curriculum. For example, the process titled "Flux Shielded Metal Arc Welding (SMAW),"¹¹ met the criteria or rule for inclusion since it received an importance rating of 4.678 (Q_2) and an IQR of 1.651.¹² The IQR for this process, in the importance rating column, did indicate some spread or disagreement among the respondents since it was slightly higher than 1.25; however, since the median was quite high, it was decided that it would be included in the welding curriculum. The spread was probably high because many of the respondents felt the process was being replaced with the Gas Shielded Metal Arc Welding (GMAW) and Flux-Core Metal Arc Welding (FCAW) processes.¹³ The other rules can be interpreted in a similar manner and the author asks the reader to refer to the table for a description of the other rules.

Results Of Information Collected And Decisions Made

Table XXI summarizes the present use and future trend

¹¹See Appendix I. p. 129.

¹²See Table XXI. p. 53, Item 1.

¹³This is a subjective interpretation made by this author after interviewing the respondents and analyzing the data.

TABLE XX

CRITERIA USED IN DETERMINING WHICH WELDING PROCESSES
WILL BE INCLUDED AND EMPHASIZED IN THE
WELDING CURRICULUM AT
BLACKHAWK TECH

Present Use Column (Importance Rating)		Future Use Column (Trend Rating)		
Q_2 (Median)	IQR	(Median)	IQR	Decision Rules
3.00 and more	1.25 and less	3.00 and more	1.25 and less	Item will be placed in the curriculum.
2.99 and less	1.26 and more	3.00 and more	1.25 and less	Sub groups will checked and if one of them, meets the criteria for in- clusion the item will be included in the curriculum.
2.00 to 2.99	1.25 and more	4.00 and more	1.25 and less	Item will be placed in curriculum.
1.00 to 1.99	1.25 and less	4.00 and more	1.25 and less	Monitor for future inclusion.

TABLE XXI

THE PRESENT USE AND FUTURE TREND RATINGS OF THE WELDING
PROCESSES USED IN THE INDUSTRIES HIRING
INEXPERIENCED BEGINNING WELDORS^a

Welding Processes ^b (Priority Ranking)	Present Use (Importance Rating)		Future Trend (5 yr.)	
	Q ₂	IQR	Q ₂	IQR
1. Flux Shielded Metal Electrode Arc Welding (SMAW)	4.678	1.651	3.178	0.940
2. Inert Gas Shielded Metal Arc Welding (GMAW)	4.615	3.918	3.218	0.848
3. Oxy-Fuel Gas Cutting (OFC)	4.250	1.841	3.105	0.605
4. Braze Welding	3.050	1.333	3.052	0.605
5. Inert Gas Shielded Tungsten Arc Welding (GTAW)	1.750	2.927	3.117	0.676
6. Oxy-Acetylene Welding (OAW)	1.458	1.395	3.117	0.638
7. Resistance Spot Welding (RSW)	1.266	2.033	3.176	0.703
8. Air Carbon Arc Welding (CAC)	1.218	1.057	3.075	0.574
9.5. Flux Core Gas Shielded Metal Arc Welding (FCAW)	1.075	0.574	3.050	0.549
9.5. Submerged Arc Welding (SAW)	1.075	0.574	3.138	0.638
11. Stud Welding (SW)	1.047	0.547	3.050	0.547
12. Plasma Arc Cutting (PAC)	1.022	0.522	3.075	0.574
13. Plasma Arc Welding (PAW)	1.000	0.500	3.075	0.574

^aThe other types of industries responded in a similar manner.

^bOther processes mentioned were: (1) Spray Powder Transfer Welding, (2) Inertia Welding, (3) Lead Welding, (4) Electro Slag Welding, (5) Gas Shielded Metal Arc Spot Welding, and (6) Laser Welding.

ratings of the welding processes used in the companies hiring inexperienced weldors. The process receiving the highest Q_2 (median) in the importance rating column ranked number one and will be given the most emphasis in the curriculum; however, the process receiving the lowest median will, unless the future trend median is extremely high, be given the least emphasis. None of the processes will be eliminated from the curriculum without the approval of the proper officials.¹⁴

The table indicates that the three processes receiving the highest importance ratings, in order of importance, were: (1) Flux Shielded Metal Electrode Arc Welding - SMAW, (2) Inert Gas Shielded Metal Arc Welding - GMAW, and (3) Oxy-Fuel Gas Cutting - OFC, while, the three processes receiving the lowest ratings were: (1) Plasma Arc Welding - PAW, (2) Plasma Arc Cutting - PAC, and (3) Stud Welding - SW. Three of the thirteen processes, in the importance rating column, had high IQR's; they are: (1) Inert Gas Shielded Metal Arc Welding - GMAW (IQR = 3.918), (2) Inert Gas Shielded Tungsten Arc Welding - TIG (IQR = 2.927), and (3) Resistance Spot Welding - RSW (IQR = 2.033). The author is uncertain as to why these spreads, or lack of agreement among the respondents exist; more research is required. The future trend rating for all thirteen welding processes had medians (Q_2) over 3.000 and less than 3.219 with inter quartile ranges (IQR) of more than 0.546 and less than 0.941. This small spread

¹⁴School Officials and/or Welding Advisory Committee members.

indicates that the majority of the respondents agree that the processes will stay the same or increase very slightly over the next five years.

Several of the respondents listed other welding processes used in their plants in the column titled "Other"; they are: (1) Spray Powder Transfer Welding, (2) Inertia Welding, (3) Lead Welding, (4) Electro Slag Welding, (5) Gas Shielded Metal Arc Spot Welding, and (6) Laser Welding.

The above information was a summary of the responses of those companies hiring inexperienced weldors. The response pattern of the other companies or sub-groups was very similiar; hence, they will not be summarized in this report.¹⁵

¹⁵Information concerning the responses of the other sub-groups is available from the author.

Welding Tasks

Section IV of the survey form covers welding tasks.¹⁶ This section includes two verticle columns - the first column lists eight-seven welding tasks most commonly performed by weldors in the industries of Blackhawk Technical Institute; the second column, a five point rating scale, asked the respondents to rate tasks related to the activities performed by inexperienced beginning weldors under the following headings: (1) U Unimportant - Does Not Perform The Task, (2) MI Moderately Important, (3) I Important - Performs Task With Supervision, (4) VI Very Important, and (5) EI Extremely Important - Performs Task Without Supervision.

This section, upon evaluation, has provided a priority listing of the tasks industry feels inexperienced beginning weldors should be able to perform before being employed in their plants. Decision rules were drawn-up and the tasks meeting the criteria for inclusion in the welding curriculum were given the highest position on the priority listing. The rules used for selecting and ranking the tasks are described in the following paragraphs.

Decision Rules For Selecting Welding Tasks

After the interviewing process was completed and the data analyzed, several decision rules were drawn-up to aid the author in determining which welding tasks would be

¹⁶See Appendix I. pp. 130 - 132.

included or omitted from the welding curriculum. The criteria and/or decision rules are presented in Table XXII. The table, based on Q_2 (median) and IQR (inter quartile range), indicates that the tasks receiving a Q_2 of 3.00 and more with an IQR of 1.25 and less will be included and emphasized in the curriculum; whereas, the tasks receiving a Q_2 of 2.99 and less with an IQR of 1.26 and more will be checked according to sub-groups (companies hiring weldors, companies not hiring weldors, companies hiring experienced weldors, and companies hiring inexperienced weldors when experienced weldors were not available in the job market) and, if they meet the criteria for inclusion, they will be included in the welding program and/or curriculum. The tasks receiving a Q_2 of 2.00 to 2.99 with an IQR of 1.25 and less will be included in the curriculum. The tasks receiving a Q_2 of 1.00 to 1.99 and an IQR of 1.25 and less will, upon the approval of the advisory committee, be omitted or monitored for future inclusion. For example, the welding task titled "Inventory - (help with shop annual inventory)"¹⁷ received a Q_2 of 2.200 and an IQR of 2.343¹⁸ but was not included in the curriculum because none of the sub-groups gave it a Q_2 (median) of 2.99 or higher and an IQR of 1.25 and less. The other decision rules in the table are interpreted in a similiar manner.

¹⁷See Appendix I. p. 132, Item 80.

¹⁸See Table XXIII. p. 65, Item 44.

TABLE XXII

CRITERIA USED IN DETERMINING WHICH WELDING TASKS
WILL BE INCLUDED AND EMPHASIZED IN THE
WELDING CURRICULUM AT
BLACKHAWK TECH

Welding Tasks		
Q ₂ (Median)	IQR	Decision Rules
3.00 and more	1.25 and less	Item will be placed in the curriculum.
2.99 and less	1.26 and more	Sub groups will be checked and if one of them meets the criteria for inclusion the item will be included in the curriculum.
2.00 to 2.99	1.25 and less	Item will be placed in the curriculum.
1.00 to 1.99	1.25 and less	Monitor for future inclusion.

Results Of Information Collected And Decisions Made

Table XXIII summarizes the welding tasks the companies, those hiring inexperienced weldors, felt beginning weldors should be able to perform, or be familiar with, before being employed in their plants. The task receiving the highest median (Q_2) in the importance rating column ranked number one and will be given the most emphasis in the curriculum; while, the process receiving the lowest median will be given the least emphasis. None of the tasks will be eliminated from the curriculum without the approval of the proper officials.¹⁹ The table is divided into the following three sections: (1) Section I - Welding tasks to be included in curriculum and given high emphasis ($Q_2 = 3.000 - 5.000$), (2) Section II - Welding tasks to be included in curriculum and given medium emphasis ($Q_2 = 2.000 - 2.999$), and (3) Section III - Welding tasks to be omitted and/or given little emphasis in the curriculum ($Q_2 = 1.000 - 1.999$). Of the eighty-two tasks, thirty are included in Section I, twelve in Section II, and forty in Section III. The table shows that the five tasks receiving the highest ratings in Section I were: (1) Get along with fellow employees, (2) Safely Extinguish fires, (3) Communicate with fellow employees (oral and written), (4) Clean and maintain welding area, and (5) Arc weld (stick electrode) metal pieces together in flat, horizontal and verticle-up position. The five tasks receiving

¹⁹School Officials and/or Welding Advisory Committee members.

the lowest ratings in Section III were: (1) Estimate the cost of welding joints, (2) Flame cut steel plate or structural shapes using natural gas, (3) Carbon arc welding (repair), (4) Carbon arc welding (production), and (5) Fuel gas - under water cutting.

For a description of how the tasks will be used the author asks the reader to refer to Table XXIII and XXIV. Table XXIV indicates the courses, in the welding program, at Blackhawk Tech that may emphasize the various tasks in their curriculum.²⁰ The tasks in the table are identified by the priority ranking number found in table XXIII.

²⁰ Some of the tasks will be emphasized in more than one curriculum and/or course.

TABLE XIII

WELDING TASKS COMPANIES FELT INEXPERIENCED
WELDERS SHOULD BE ABLE TO PERFORM OR
BE FAMILIAR WITH BEFORE BEING
EMPLOYED IN THEIR PLANTS

(N = 23)

Section I

Welding Tasks To Be Included In Curriculum (High Emphasis - 3.000 to 5.000)	Q_2	IQR	Priority Rating
1. Get along with fellow employees	4.823	0.711	1
2. Safely extinguish fires	4.733	1.179	2
3. Communicate with fellow employees (written and oral)	4.678	1.239	3
4. Clean and maintain welding area	4.285	1.474	4
5. Arc weld (stick electrode) metal pieces in flat, horizontal and verticle-up positions	4.083	1.736	5
6. Tack weld assemblies together in all positions	3.888	1.416	6
7. Clean and polish welds using grinder and chipper	3.857	3.357	7
8. Set-up, adjust and operate according to work order, operating chart, blueprint, and layout chart - arc welding equipment	3.777	1.380	8

TABLE XXIII (Cont.)

9. Clean and or degrease work pieces using wire brush and grinder	3.777	1.729	9
10. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, gas fuel cutting equipment	3.777	1.979	10
11. Maintain welding and cutting equipment (repair or replace broken parts - minor items only)	3.666	1.655	11
12. Follow directions given by signals (auditory and visual)	3.600	3.357	12
13. Layout and prepare metal joints, parts or products preparatory to welding	3.583	1.697	13
14. Treat <u>minor</u> (first aid) injuries	3.583	2.125	14
15. Measure parts with calipers and dividers	3.583	2.666	15
16. Position, clamp and assemble work pieces in jigs and fixtures	3.444	1.569	16
17. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, abrasive cutting wheel equipment	3.428	1.549	17
18. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, drilling equipment	3.312	1.513	18
19. Flame cut steel plate or structural shapes using oxy-acetylene gas	3.285	1.958	19

TABLE XXIII (Cont.)

20. Compute simple mathematical problems related to metal fabrication and repair	3.250	2.458	20
21. Soften, form and/or bend metal with flame	3.250	2.474	21
22. Saw metal (machine)	3.250	2.645	22
23. Prepare a personal data sheet to present with the job application form	3.250	2.937	23
24. Control distortion when cutting and welding	3.222	1.566	24
25. Test pressure hoses for leaks	3.083	2.690	25
26. File metal (manually)	3.083	2.828	26
27. Arc weld (stick electrode) metal pieces in the overhead position	3.083	3.083	27.5
28. Attach grappling equipment (hooks, clamps, etc.) to objects preparatory to movement by self	3.083	3.083	27.5
29. Store supplies	3.050	1.395	29
30. Saw metal (manually)	3.000	2.891	30

TABLE XXIII (Cont.)

Section II

Welding Tasks To Be Included In Curriculum

(Medium Emphasis 2.000 to 2.999)	Q ₂	IQR	Priority Rating
31. Straighten metal with flame	2.888	2.261	31
32. Tap holes that have been drilled in metal (hand tools - not power driven)	2.875	2.966	32
33. Silver braze and/or solder ferrous and nonferrous metals	2.857	2.673	33
34. Attach grappling equipment (hooks, clamps, etc.) to objects preparatory to movement by somebody else	2.857	2.777	34
35. Assemble parts by bolting and riveting	2.812	2.241	35
36. Bronze weld ferrous metals	2.687	2.084	36
37. Heat metal products preparatory to welding	2.666	2.966	37
38. Clean and/or degrease work pieces using chemical solutions	2.600	2.675	38
39. Read and use a micrometer	2.416	2.666	39
40. Keep records of jobs completed	2.000	2.133	40
41. Form and crimp metal (hand tools - manually)	2.000	2.352	41
42. Hand punch or drill holes in sheet metal preparatory to pop riveting	2.000	2.685	42

TABLE XXIII (Cont.)

Section III

Welding Tasks To Be Omitted And/Or
Given Little Emphasis In The
Curriculum - 1.000 to 1.999

	Q ₂	IQR	Priority Rating
43. Build jigs and fixtures for holding metal parts preparatory to welding ^a	2.583	2.411	43
44. Inventory (help with shop annual inventory) ^b	2.200	2.343	44
45. Keep accurate time reports (how long it takes to weld, etc.)	1.750	2.527	45
46. Read a vernier	1.666	2.289	46
47. Sharpen drills (manually)	1.458	2.970	47
48. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, fine polishing equipment	1.384	2.099	48
49. Repair welding and cutting equipment (major items only)	1.384	2.207	49.5
50. Gouging with flame (map, natural and/or oxy-acetylene gas)	1.384	2.207	49.5
51. Dress resistance spot welder copper electrode tips	1.384	2.607	51
52. Lead soldering (sheet metal)	1.321	1.651	52
53. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, power shearing equipment	1.321	1.839	53

Table XIII (Cont.)

54. Tap holes that have been drilled in metal (power driven equipment)	1.321	2.005	54.5
55. Straighten metal with straightening press	1.321	2.005	54.5
56. Shear metal (hand tools - manually)	1.321	2.239	56
57. Prepare finished parts and assemblies for shipment (count parts, compare quantity and identification numbers of items with order number, etc.)	1.321	2.339	57
58. Cut metal - machine power nibbler	1.321	2.401	58
59. Sharpen drills (machine)	1.321	2.630	59
60. Peen Straightening	1.266	1.366	60
61. Make patterns and/or templates for cutting, forming and bending plates and pipe	1.266	1.679	61
62. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, turntable equipment	1.218	1.703	62.
63. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, punch press equipment	1.176	0.786	63.5
64. Spray paint metal products	1.176	0.786	63.5
65. Harden small metal parts with torch flame	1.176	0.911	65
66. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, blast cleaning equipment	1.176	1.724	66

TABLE XXIII (Cont.)

67. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, dye penetration equipment	1.176	1.745	67
68. File metal (machine)	1.176	1.911	68
69. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, tensile testing equipment	1.138	0.638	69.5
70. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, rolling equipment	1.138	0.638	69.5
71. Flame cut steel plate or structural shapes using mapp gas	1.105	0.605	72.5
72. Air carbon arc cutting and gouging	1.105	0.605	72.5
73. Forge hot metal (hammer - manually)	1.105	0.605	72.5
74. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, magnaflux testing equipment	1.105	0.605	72.5
75. Order supplies	1.075	0.575	76.
76. Case harden metal	1.075	0.575	76.
77. Set-up, adjust and operate according to work order, blueprint, layout and operating chart, hardness testing equipment	1.075	0.575	76.

TABLE XIII (Cont.)

78. Estimate the cost of welding joints	1.047	0.547	78.5
79. Flame cut steel plate or structural shapes using natural gas	1.047	0.547	78.5
80. Carbon arc welding (repair)	1.022	0.522	80.5
81. Carbon arc welding (production)	1.022	0.522	80.5
82. Fuel gas - under water cutting	1.000	0.500	82

^aItem 43 - was put in the omitted list, even though it had a Q_2 of over 2.000, because it did not meet the criteria for inclusion as stated in the decision rules.

^bItem 44 - was put in the omitted list, even though it had a Q_2 of over 2.000, because it did not meet the criteria for inclusion as stated in the decision rules.

TABLE XXIV
COURSES IN THE WELDING PROGRAM AT BLACKHAWK
THAT WILL EMPHASIZE THE TASKS IN
THE CURRICULUM

Course Title	Welding Tasks ^a
Communication Skills	1, 3, 12, 23, and 40.
Machine Shop Fundamentals ^b	1, 2, 3, 4, 9, 12, 13, 15, 18, 22, 23, 26, 30, 32, 39, 40, and 42.
Drafting	8, 10, 13, 15, 17, 18, and 20.
Blueprint Reading For Weldors	8, 10, 13, 15, 17, 18, and 20.
Applied Economics	1, and 3.
Shop Math I - II	1, 3, 13 and 20.
Welding I - II	All of the tasks the welding Advisory Committee members, Students, and School Officials feel should be emphasized.
Basic Fundamentals of First Aid ^b	14

^aSee Table XXIII, Tasks 1 - 30.

^bThis course is not yet offered at Blackhawk Tech.

CHAPTER IV

RECOMMENDATIONS AND CONCLUSIONS

Recommendations

The author suggests that those involved with doing task analyses consider the following recommendations:

1. That a study of this kind be conducted once every three to five years for the purpose of up-dating the curriculum.
2. That this study be used as a guide for planning new courses and establishing new objectives and/or goals that would satisfy both student and industry needs.
3. That visits be made to various welding industries (those that were not able to participate in this study and others) for additional data concerning employment information, tools and equipment used by weldors, new welding processes, and welding tasks performed by weldors on the job.
4. That the individual(s) conducting task analyses seek the advice and assistance of their Advisory Committee members.
5. That before the final instruments of the survey are printed they be pre-piloted to various groups (experts in the field) for content validity.
6. That the survey forms be reconstructed using the suggestions and recommendations obtained from the respondents.
7. That the findings and recommendations be made available to the companies participating in the study, school officials and the Educational Resource Information Center Clearinghouse (E.R.I.C.).
8. That the survey instruments, before final printing, be approved by the key punch and computer operators.

Conclusions

As a result of this study, the author concluded that:

1. It seemed that most of the companies interviewed were willing to aid schools that asked for advice concerning curriculum revisions and student needs.
2. It appeared that most of the companies interviewed felt modern welding processes (semi-automatic and/or fully automated) must be introduced into the welding establishments because skilled weldors are becoming harder and harder to find.
3. Industry would be more than willing to hire vocationally trained graduates if the courses emphasized up-to-date skills and knowledge of future trends.

APPENDICES

APPENDIX A

This appendix contains the names of the Blackhawk
Technical Institute Welding Advisory Committee member.

WELDING ADVISORY COMMITTEE MEMBERS

(BLACKHAWK TECH)

(1973 - 74)

74

EMPLOYER MEMBERS

Stanley Knight
Knight Mfg. Co.
1401 8th Av.
Brodhead, Wisc. 53520
Phone: 1-608-897-2131

Phil Hamilton
Pruden Products Co.
273 Water Street
Evansville, Wisc. 53536
Phone: 1-608-882-5000

Owner

Res: 1602 West 7th Street
Brodhead, Wisconsin 53520
Phone: 1-608-897-2660

Welding Foreman

Res: Tolles Road
Evansville, Wisc. 53536
Phone: 1-608-882-5757

EMPLOYEE MEMBERS

Roger Harmon
Interpace Corp., Prairie Hill Road
South Beloit, Illinois
Phone: 1-815-389-2271

Robert Silvia
Advance Transformer
350 21st. Street
Monroe, Wisc. 53566
Phone: 1-608-325-9161

Leonard Ford
Beloit Corp.
Beloit, Wisc. 53511
Phone: 1-608-365-3311
(Dept. 2277)

H. Louis Heinze
Gardner Machine Company
481 Gardner
Beloit, Wisc. 53511
Phone: 1-608-389-2251

Weldor

Res: 1951 Nelson Av.
Beloit, Wisc. 53511
Phone: 1-608-362-1653

Plant Engineer

Res: 2004 7th Street
Monroe, Wisc. 53566
Phone: 1-608-325-5706

Weldor

Res: 1146 8th Street
Beloit, Wisc. 53511
Phone: 1-608-365-8432

Weldor

Duggan Road
Beloit, Wisc. 53511
Phone: 1-608-365-7286

BLACKHAWK TECH MEMBERS

Gerald E. Lesch
1149 4th St.
Beloit, Wisc. 53511

Francis Boigenzahn
1149 4th St.
Beloit, Wisc. 53511

Richard A. Oster
1149 4th St.
Beloit, Wisconsin 53511

Welding Instr.
Res: 1232 6th St.
Beloit, Wisc. 53511

Math Instr.
Res: 2524 Skyline Dr.
Beloit, Wisconsin 53511

T & I Division Chairman
Res: 2334 Riverside Dr.
Beloit, Wisconsin 53511

APPENDIX B

This appendix shows where Beloit is located in Wisconsin and in relationship to large urban areas.

MAP OF WISCONSIN SHOWING LOCATION OF BELOIT

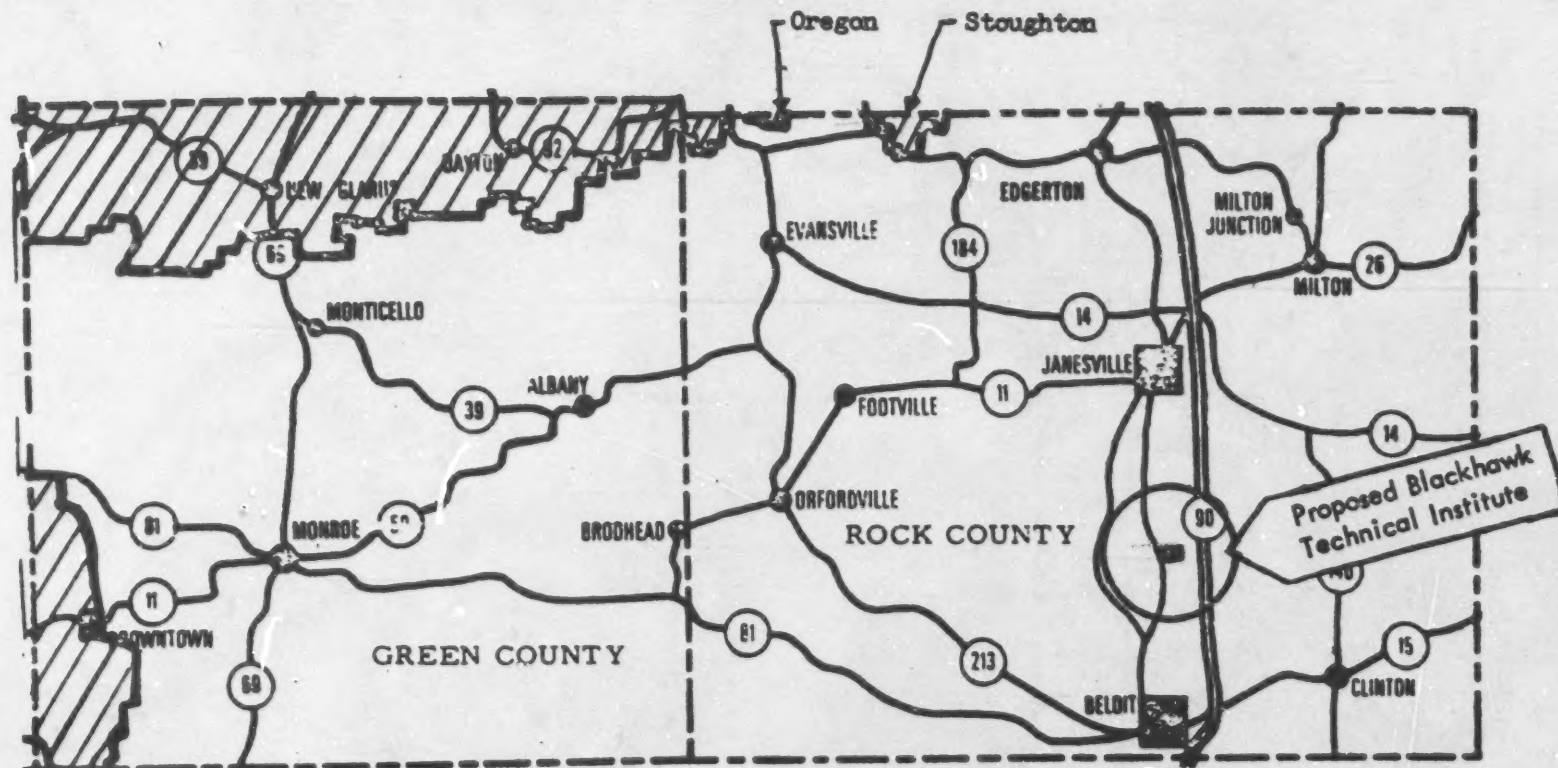




APPENDIX C

This appendix includes a map of Blackhawk Tech District, Rock and Green Counties, plus two maps of the new central facilities location.

BLACKHAWK & TECH



Major Cities

Rock County:	
Janesville	47,000
Beloit	36,000
Evansville	3,000
Edgerton	4,125
Milton	3,710
Green County:	
Monroe	8,700
Brodhead	2,520

MAP OF BLACKHAWK TECH DISTRICT - ROCK AND GREEN COUNTIES

Population

1972 - 159,735

Rock County	135,660
Green County	24,075

Land Area - 1,189 sq. miles
Acres - 760,960

79

98

Location - General Area: Hwy. 51, Sunny Lane and Hwy. G.

67% of the District's population lives within 10 miles of the facility, (107,000 people live in the 10 mile radius).

56% of the population, (88,000) live within 7 miles of the facility.



Avalon Road

P
A
B1

BLACKHAWK TECHNICAL INSTITUTE

PROPOSED

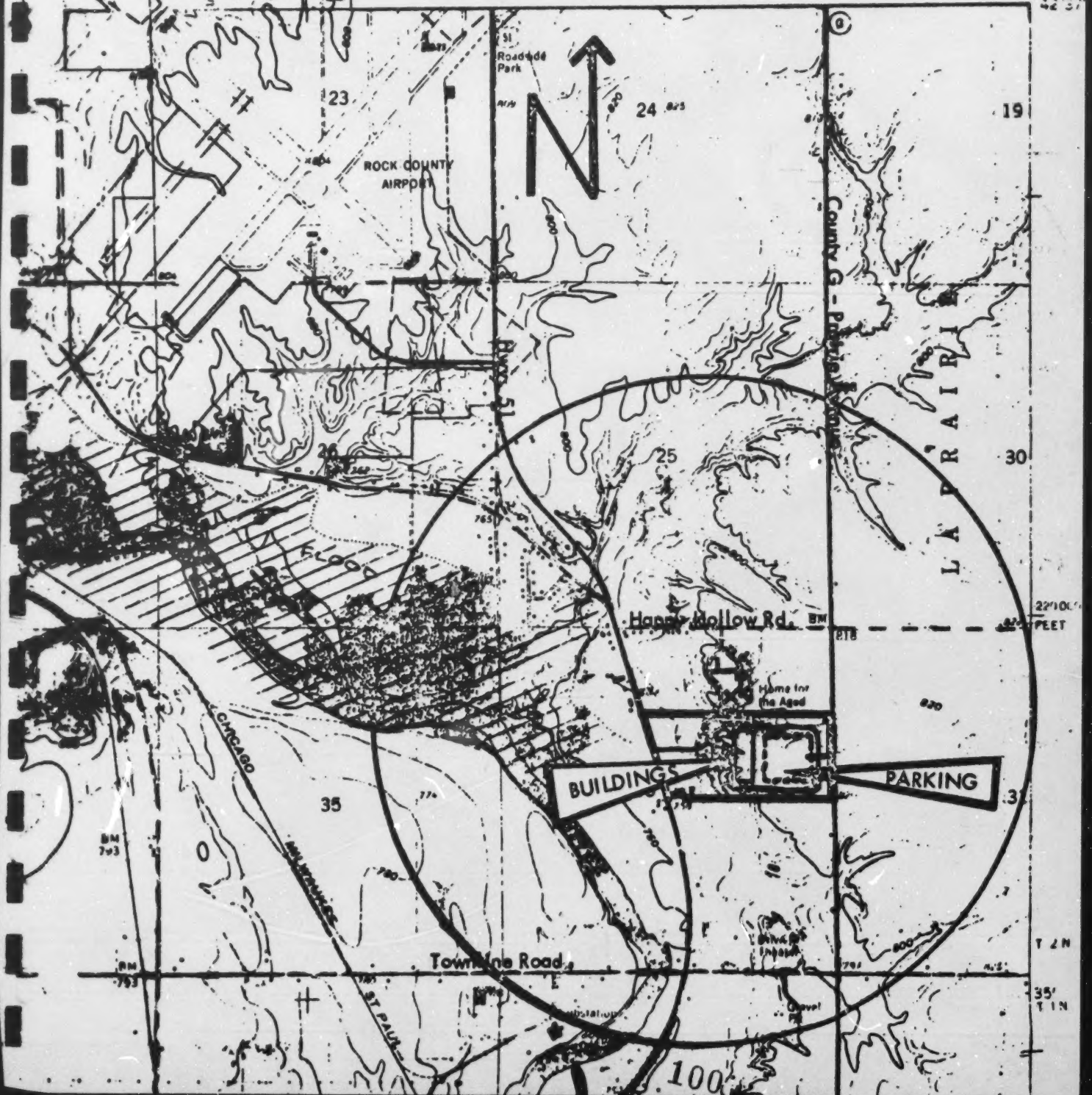
FACILITY

SITE

DETAIL MAP

421000

42 37



APPENDIX D

This appendix lists the names and addresses of the welding companies asked to participate in the survey.

APPENDIX

The following list consists of the names and addresses of the welding companies asked to participate in the survey:

A & E Sheet Metal Company 51 East Holmes Janesville, Wisconsin 53545	Carter Machine Works 1217 12th Avenue Monroe, Wisconsin 53566
Advance Transformer 350 21st Street Monroe, Wisconsin 53566	City Of Janesville Janesville, Wisconsin 53545
Akey Machine And Welding 112 North Richards Street Orfordville, Wisconsin 53576	Cheese Capital Machine Company 1800 10th Avenue Monroe, Wisconsin 53568
Allied Mills, Inc. Box 849 Janesville, Wisconsin 53545	Custom Welding, Inc. Front Clinton, Wisconsin
Baker Manufacturing Company 133 Enterprise Street Evansville, Wisconsin 53536	Dana Corporation 1220 Fulton Street Edgerton, Wisconsin 53534
Bee Line Wheel & Frame Alignment 25 Saint Lawrence Street Janesville, Wisconsin 53545	Dean Foods, Inc. 216 Center Avenue Janesville, Wisconsin 53545
Beloit Box Board Company 801 2nd Street Beloit, Wisconsin 53511	Durst Corporation Post Office Box 298 Beloit, Wisconsin 53511
Beloit Corporation Saint Lawrence Avenue Beloit, Wisconsin 53511	Eastman Manufacturing Company 219 East Milwaukee Street Janesville, Wisconsin 53545
B. J. T. Enterprises Highway 26 Milton, Wisconsin 53545	Exact Products Butterfly Road Beloit, Wisconsin 53511
Burdick Corporation 15 Plumb Street Milton, Wisconsin 53563	Fairbanks Morse & Company - Power Systems Divisions - Colt Industries Park Avenue Beloit, Wisconsin 53511

Fox Corporation
1111 West Racine
Janesville, Wisconsin 53545

Freeman Shoe Company
Post Office Box 271 - Mill Street
Beloit, Wisconsin 53511

Frito Lay, Inc.
2810 Dennedy Drive
Beloit, Wisconsin 53511

Geo. A. Hormel Company
300 Kennedy Drive
Beloit, Wisconsin 53511

General Motors Assemble Division -
General Motors Corporation -
Janesville Plant
1000 Industrial Avenue
Janesville, Wisconsin 53545

Gilman Engineering & Manufacturing
Corporation
305 West Delavan Drive
Janesville, Wisconsin 53545

Helgesteel Corporation
2833 Milton Avenue
Janesville, Wisconsin 53545

Hendley Beloit Corporation
Box 595
South Beloit, Illinois

Highway Department - Rock County
Route 4
Janesville, Wisconsin 53545

Highway Trailer Manufacturing
Corporation
405 East Fulton Street
Edgerton, Wisconsin 53534

Hitzman Welding
Box 43
Brodhead, Wisconsin 53520

Hough Manufacturing Company
1029 South Jackson Street
Janesville, Wisconsin 53545

Industrial Combustion Company
351 21st. Street
Monroe, Wisconsin 53566

Janesville Auto Transport Company
1263 South Cherry Street
Janesville, Wisconsin 53545

Janesville Construction Company
227 South Crosby Avenue
Janesville, Wisconsin 53545

Janesville Products
1107 First Center Avenue
Brodhead, Wisconsin 53520

Knight Manufacturing Company
1401 8th Avenue
Brodhead, Wisconsin 53520

Lyle T. Manley Company

Hanover, Wisconsin 53442

Monroe Machine & Welding
907 7th Avenue
Monroe, Wisconsin 53566

Moore Business Forms, Inc.
350 17th Street
Monroe, Wisconsin 53566

Northern Conveyor Company
2200 Foster Avenue
Janesville, Wisconsin 53545

Northern Petro Chemical
2201 Afton Road
Janesville, Wisconsin 53545

Norwood Mills
2101 Kennedy Drive
Janesville, Wisconsin 53545

Nutrena Mills - Division Of
Cargill, Inc.
411 South Pearl Street
Janesville, Wisconsin 53545

Osborn's Inc. - Plumbing & Heating
145 West Grand Avenue
Beloit, Wisconsin 53511

Ossit Corporation
251 Hyatt
Janesville, Wisconsin 53545

Parker Pen Company
219 East Court
Janesville, Wisconsin 53545

Rath Manufacturing Company
112 South Pearl Street
Janesville, Wisconsin 53545

R. W. Ryan Construction Company
312 West Milwaukee
Janesville, Wisconsin 53545

Roy's Sanitary Dairy
1701 1/2 11th Street
Monroe, Wisconsin 53566

R. Mueller Cheese Factory
Equipment Company
1412 13th Street
Monroe, Wisconsin 53566

Ryan Inc.
Post Office Box 206 (Hy. 14)
Janesville, Wisconsin 53545

Solway Corporation
Box 154
Monroe, Wisconsin 53566

Studer Super Service
1703 6th Street
Monroe, Wisconsin 53566

Summit Machine Works Inc.
Hy. 15
Beloit, Wisconsin 53511

Swiss Colony Customer Service

Monroe, Wisconsin 53566

Tang Industries - Power Systems
Division
701 Lawton Avenue
Beloit, Wisconsin 53511

The Schlueter Company
112 East Centerway
Janesville, Wisconsin 53545

T. S. Willis
1 - South Main Street
Janesville, Wisconsin 53545

United Industries, Inc.
1546 Henry Avenue
Beloit, Wisconsin 53511

Universal Foods, Inc.
1115 Elaine Drive
Beloit, Wisconsin 53511

Utzig Body Shop
1715 West Court Street
Janesville, Wisconsin 53545

Vivid Signs
Box 307 (Hy. 15)
Janesville, Wisconsin 53545

Varco Pruden, Inc.
Plant No. 1
273 Water Street
Evansville, Wisconsin

Whitehead & Riese
1821 8th Street
Monroe, Wisconsin 53566

Wisconsin Knife Works
2710 Prairie Avenue
Beloit, Wisconsin 53511

Wright & Wagner Dairy
525 Cross
Beloit, Wisconsin 53511

Wilson & Shieler Construction
Company
Shirland Avenue and Highway 15
Beloit, Wisconsin 53511

APPENDIX E

This appendix contains a copy of the rough draft of the survey instruments developed in 1972, in a course entitled "Instrumentation For Research" - University of Wisconsin - Stout.

A WELDING SURVEY OF THE BLACKHAWK TECHNICAL INSTITUTE INDUSTRIES 88

(UP-DATING THE WELDING CURRICULUM)

INSTRUMENTATION

PROJECT

by

Gerald E. Lesch

August 8, 1972

OBJECTIVES:

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The objectives of this study are to:

- (1) determine the trends and hiring policies of the welding industries in Rock and Green counties.
- (2) determine the tools and equipment a beginning welder should purchase for employment.
- (3) determine the kinds of welding processes, their importance and future trends, presently being used in the industries or Rock and Green counties.
- (4) determine the professional ratings of the tasks industry feels beginning welders should know for employment in their plants.

RATIONALE FOR STUDY

Curriculum revision movements are underway today in nearly all subject areas being taught in the vocational, technical institutes. This is because of the dynamic technological and scientific advances being made from day to day in all areas of industry. In the welding industry alone new discoveries and techniques are being disclosed daily. Information concerning them must be made available to the schools if they are going to continue to teach the skills and knowledges students should possess for employment. The failure to get this information from industry will only widen an already existing gap and force them to set up their own specialized training courses. Several factories (Fairbanks Morse, Beloit Corporation, etc.) have already considered initiating such courses in their plants. This thinking can only be reversed when school officials and program instructors get together with various industrial representatives to discuss and exchange information that is pertinent to each others particular needs.

Mr. M. J. Davis, supervisor of the training program at the Central Electric Company, indicates the need for educational institutions and industry to get together and exchange information with one another by stating:

Since industry is one of the principle customers for the end product of a school system and is vitally interested in the abilities and potential of the product, it seems only logical that industry should play a leading role in closing that gap.

In Rock and Green counties the industries are more than willing to exchange ideas and information with school officials and program instructors at the Blackhawk Technical Institute - District No. five, Beloit, Wisconsin. It is through this exchange of information that the one-year vocational welding program in District No. five is continuously being up-dated. Yet every year the local industries of Rock and Green counties ask for weldors who are qualified and competent to perform modern welding tasks. It is in

¹M. J. Davis "Closing the Education-Industry Interface Gap," Technical Educational News, (January - February 1970), P. 7.

²The term "weldor" as related to this study means: The person or operator who makes welds or operates welding equipment.

the light of these things that the one-year vocational welding program in District No. five is being up-dated.

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It is hoped that by up-dating the welding program the following goals will be met:

- (1) To educate students as individuals, by considering individual needs and interests as they relate to his or her particular field.
- (2) To be able to prepare the students for gainful employment.
- (3) To be able to provide the opportunities for the up-grading of employees.
- (4) To be able to provide the students with skills for improving and up-grading their employment opportunities.
- (5) To recruit and motivate people to enroll in the welding program.
- (6) To develop in students an acceptable work attitude towards the welding field.
- (7) To enrich a students knowledges and skills in a chosen field of welding.
- (8) To provide a welding program which will be available to all interested members of the community.
- (9) To motivate students to extend themselves in their trade through independent research and/or study.
- (10) To prove to students that they have an important place in life, one with dignity, status and prestige in a job requiring an education of less than a baccalaureate degree.

If the welding program is to attain the above goals as well as the occupational preparation for weldors and at the same time improve public relations between the school and local community it must employ those skills and competencies industry claims are essential for all weldors to possess. Thus the purpose of this study is to survey the local welding industries in Rock and Green counties to determine the professional ratings of the tasks a beginning weldor must be able to perform for employment. It is also intended that this study will give realistic opinions and suggestions on equipment and tools required for employment along with industrial trends and hiring policies.

*Note: A follow-up study pertaining to this survey will be conducted approximately 1 - 2 years later.

1. Flux shielded metal electrode arc welding -- A process where fusion is achieved by generating an electric arc between a coated metallic electrode and the workpiece.
2. Flux-gas shielded metal arc welding -- A flux cored welding process which uses the intense heat of an electric arc between a cored, consumable, continuously fed electrode wire and the work. (MIG Process)
3. Inert gas shielded metal arc welding -- A MIG welding process where fusion is produced by an electric arc between the workpiece and a continuous consumable wire electrode with a protective shield of gas - no flux used - solid wire.
4. Weldor -- The person operating welding equipment.
5. Welder -- The equipment a weldor uses.
6. Oxygen Arc Cutting -- An arc cutting process whereby the cutting is accomplished by directing a stream of oxygen (through a consumable coated mild steel tubular cutting rod) into the pool of molten metal. The pool is made and kept molten by the electric arc. *and it is heated*
7. Plasma Arc Cutting -- (Gas Tungsten-Arc Cutting) A cutting process whereby an electric arc passes through a gas and ~~heat its~~ to such a high temperature (40,000 - 60,000 deg. F.) that it turns into what physicists call "plasma". Plasma is the fourth state of matter. This plasma, when forced through a restricted nozzle at several thousand feet per second, removes molten metal from the work and creates a kerf free from contamination and oxidation.
8. Plasma Arc Welding -- A welding process whereby an electric arc passes through a gas and ~~heats its~~ to such a high temperature that it causes it to become ionized. The ionized gas is known as plasma. This plasma, when forced through a water-cooled torch, melts a predetermined area of the work piece to be welded. Filler metal is then added to the molten pool and a weld is produced.

BLACKHAWK VOCATIONAL TECHNICAL SCHOOL

Vocational, Technical and Adult Education - District Five

Serving Rock and Green Counties

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DIRECTIONS: Please fill in the information requested or mark (✓) the appropriate response. A list of definitions is included in this form for your reference. You will not be identified with your responses in our report, thus, feel free to be candid in your responses.

General ?

I. Employment Information

1. Company Name: _____
2. Address: _____ Zip: _____
3. Title: _____ Dept: _____
4. What are your minimum formal education requirements for hiring a beginning weldor? (✓ appropriate response)

_____ 1. Grade School	_____ 5. 2 Years College
_____ 2. High School	_____ 6. 4 Years College
_____ 3. 1 Year Post High School	_____ 7. Other: _____
_____ 4. 2 Years Post High School	
5. Does your department hire inexperienced weldors? ☐ 1. Yes ☐ 2. No
6. If the answer to question (5) is "Yes", please indicate the average plant hours your department spends in training a beginning weldor? _____
7. If the answer to question (5) is "No", please indicate your requirements regarding the experiences for a beginning weldor? _____
8. Will your department hire additional weldors next year? . . . ☐ 1. Yes ☐ 2. No
9. Would you consider employing 1 year vocational weldors? . . . ☐ 1. Yes ☐ 2. No
10. Does your plant certify its own weldors? ☐ 1. Yes ☐ 2. No
11. If the answer to question (10) is "Yes", please indicate the type of certification test required? (✓ appropriate response)

_____ 1. State	_____ 3. Other: _____
_____ 2. Local	_____ 4. Other: _____
12. What is the total number of weldors presently employed in your plant? _____
13. What is the average number of vacancies that occur in your welding department during a given year? _____
14. How many weldors have been hired in your department in the past year? _____
15. What is the average hourly wage for a beginning weldor in your department? _____
16. Which statement best describes the employment of weldors in your plant in the next five years? (✓ appropriate response)

_____ 1. Increase	_____ 2. Decrease
-------------------	-------------------

17. What is the job classification of most of your weldors? (✓ appropriate response)
- | | |
|----------------------|--------------------------|
| _____ 1. Apprentice. | _____ 3. None |
| _____ 2. Journeyman | _____ 4. Other: _____ 94 |
18. What periodical or magazine do you feel beginning weldors should read? (✓ appropriate response)
- | | |
|---------------------------|-----------------------|
| _____ 1. Welding Journal | _____ 3. |
| _____ 2. Welding Engineer | _____ 4. Other: _____ |
19. In the space provided below, please list and briefly describe any special alloys frequently welded in your shop? (After you have listed these please go on to Section II.)

Special Alloys

Special Welding Processes Used

DIRECTIONS: Listed below are tools and equipment used by weldors on the job. Read each item and determine which of them you feel a beginning weldor should purchase upon employment into your welding department. If you feel there are other tools or equipment that a beginning weldor should purchase for employment and it has been omitted, please list it in the space labeled as "other" and rate it according to its importance. Circle the number on the right representing your response. Please review the rating codes given below.

1. = NU - Not Used, 2. = N - Nice to Have, 3. = E - Essential, 4. = CP - Company Provided

	<u>NU</u>	<u>N</u>	<u>E</u>	<u>CP</u>
1. Adjustable Wrench (10" or 12")	1	2	3	4
2. Chalk Line	1	2	3	4
3. Center Punches (Small and Large)	1	2	3	4
4. Chipping Hammer (Slag)	1	2	3	4
5. Chisels (Medium and Large)	1	2	3	4
6. Combination Steel Square (Complete Set)	1	2	3	4
7. Micrometer (0" to 1")	1	2	3	4
Personal Protective Equipment:				
8. Leather Apron	1	2	3	4
9. Leather Gloves	1	2	3	4
10. Leather Leggings	1	2	3	4
11. Safety Goggles	1	2	3	4
12. Welding Helmet	1	2	3	4
13. Hard Safety Hat	1	2	3	4
14. Other: _____	1	2	3	4
15. Hammer (16. oz. and/or 40 oz.)	1	2	3	4
16. Pliers (Combination Slip Joint - 6" or 10")	1	2	3	4
17. Scratch Awl	1	2	3	4
18. Steel Scale (6")	1	2	3	4
Steel Tape:				
19. 10 foot	1	2	3	4
20. 12 foot	1	2	3	4
21. 15 foot	1	2	3	4
22. 20 foot	1	2	3	4
23. 50 foot	1	2	3	4
24. 100 foot	1	2	3	4
25. _____ foot	1	2	3	4
26. Trammel Points	1	2	3	4
27. Wire Brush (Hand)	1	2	3	4
28. Other: _____	1	2	3	4
29. Other: _____	1	2	3	4

DIRECTIONS: Listed below are several welding processes. These processes were selected on their frequent occurrence based on my contacts with welding supervisors, foremen, engineers and welding instructors in Wisconsin. Rate the importance of each welding process to the welding jobs in your shop and estimate the trends for its use over the next five years. In this section you will make two responses to each item. Please circle your responses. If you employ welding processes that have been omitted, please list them in the space labeled as "other" and rate its importance and the trend for its use over the next ten years. A list of definitions is included in this form for your reference. Please review the rating codes given below.

Importance Ratings:

5. AE - Absolutely Essential
 4. VI - Very Important
 3. INE - Important, but Not Essential
 2. MI - Moderately Important
 1. U - Unimportant

Trend Ratings:

5. RI - Rapid Increase
 4. MI - Moderate Increase
 3. SS - Stay the Same
 2. MD - Moderate Decrease
 1. RD - Rapid Decrease

Welding Processes:

Present Use -
Importance Ratings:

Future Use -
Trend Ratings:

	<u>U</u>	<u>MI</u>	<u>INE</u>	<u>VI</u>	<u>AE</u>	<u>RD</u>	<u>MD</u>	<u>SS</u>	<u>MI</u>	<u>RI</u>
1. Air Carbon Arc Cutting	1	2	3	4	5	1	2	3	4	5
2. Braze Welding	1	2	3	4	5	1	2	3	4	5
3. Flux Shielded Metal Electrode Arc Welding	1	2	3	4	5	1	2	3	4	5
4. Flux-gas shielded Metal Arc Welding	1	2	3	4	5	1	2	3	4	5
5. Inert Gas Shielded Metal Arc Welding	1	2	3	4	5	1	2	3	4	5
6. Inert Gas Shielded Tungsten Arc Welding	1	2	3	4	5	1	2	3	4	5
7. Oxy - Acetylene Welding	1	2	3	4	5	1	2	3	4	5
8. Oxygen Arc Cutting	1	2	3	4	5	1	2	3	4	5
9. Oxy - Fuel Gas Cutting	1	2	3	4	5	1	2	3	4	5
10. Plasma Arc Cutting	1	2	3	4	5	1	2	3	4	5
11. Submerged Arc Welding	1	2	3	4	5	1	2	3	4	5
12. Spot Welding	1	2	3	4	5	1	2	3	4	5
13. Plasma Arc Welding	1	2	3	4	5	1	2	3	4	5
14. Other: _____	1	2	3	4	5	1	2	3	4	5
15. Other: _____	1	2	3	4	5	1	2	3	4	5
16. Other: _____	1	2	3	4	5	1	2	3	4	5

DIRECTIONS: Listed below are a variety of welding tasks performed by weldors in industry. Read each task and determine which of them a beginning weldor should know and be able to perform for employment into your shop. Rate the importance of each task by circling the appropriate number on the right representing your response. If you feel certain tasks have been omitted, please list them in the space labeled as "other" and rate its importance. A list of definitions is included in this form for your reference. Please review the rating codes given below.

5. AE - Absolutely Essential
 4. VI - Very Important
 3. INE - Important, but Not Essential
 2. MI - Moderately Important
 1. U - Unimportant

	<u>U</u>	<u>MI</u>	<u>INE</u>	<u>VI</u>	<u>AE</u>
1. Build jigs and fixtures for holding metal parts preparatory to welding	1	2	3	4	5
2. Silver braze and/or solder ferrous and nonferrous metals	1	2	3	4	5
3. Make patterns and/or templates for cutting, forming, and bending plates and pipe	1	2	3	4	5
4. Estimate cost of welding joints	1	2	3	4	5
5. Control distortion when cutting and welding	1	2	3	4	5
6. Drive and operate a forklift	1	2	3	4	5
7. Maintain welding and cutting equipment (repair or replace broken parts).	1	2	3	4	5
8. Test pressure hoses for leaks	1	2	3	4	5
9. Measure parts with calipers and dividers	1	2	3	4	5
10. Form and crimp metal (hand tools - manually)	1	2	3	4	5
11. Tap, drilled holes in metal (hand tools - not power driven) . . .	1	2	3	4	5
12. Tap, drilled holes in metal (power driven tools and/or equipment)	1	2	3	4	5
13. Clean and/or degrease work pieces using wire brush and grinder .	1	2	3	4	5
14. Clean and/or degrease work pieces using chemical solutions . . .	1	2	3	4	5
15. Clean and polish welds using grinder and chipper	1	2	3	4	5
16. Heat metal product preparatory to welding	1	2	3	4	5
17. Position, clamp and assemble work pieces in jigs and fixtures .	1	2	3	4	5
18. Tack weld assemblies together in all positions	1	2	3	4	5
19. Saw metal (manually)	1	2	3	4	5
20. Saw metal (machine)	1	2	3	4	5
21. File metal (manually)	1	2	3	4	5
22. File metal (machine)	1	2	3	4	5
23. Read and use a micrometer	1	2	3	4	5
24. Layout and prepare metal joints, parts or products preparatory to welding	1	2	3	4	5

IV. Welding Tasks - cont.

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5. AE - Absolutely Essential
4. VI - Very Important
3. INE - Important, but Not Essential
2. MI - Moderately Important
1. U - Unimportant

	<u>U</u>	<u>MI</u>	<u>INE</u>	<u>VI</u>	<u>AE</u>
25. Sharpen drills (manually)	1	2	3	4	5
26. Sharpen drills (machine)	1	2	3	4	5
27. Spray paint metal products	1	2	3	4	5
28. Attach grappling equipment to objects preparatory to movement by self	1	2	3	4	5
29. Attach grappling equipment to objects preparatory to movement by overhead crane operator	1	2	3	4	5
30. Order supplies	1	2	3	4	5
31. Assemble parts by bolting and riveting	1	2	3	4	5
32. Dress resistance spot welder copper electrode tips	1	2	3	4	5
33. Straighten metal with flame	1	2	3	4	5
34. Straighten metal with straightening press	1	2	3	4	5
35. Shear metal (hand tools - manually)	1	2	3	4	5
36. Flame cut steel plate or structural shapes using mapp gas	1	2	3	4	5
37. Flame cut steel plate or structural shapes using natural gas	1	2	3	4	5
38. Flame cut steel plate or structural shapes using oxy-acetylene gas	1	2	3	4	5
39. Set-up, adjust and operate power shearing equipment according to work order, blueprint, layout and operating charts	1	2	3	4	5
40. Cut metal - machine power nibbler	1	2	3	4	5
41. Carbon arc welding (repair)	1	2	3	4	5
42. Carbon arc welding (production)	1	2	3	4	5
43. Case harden metals	1	2	3	4	5
44. Air carbon arc cutting and gouging	1	2	3	4	5
45. Gouging with flame (mapp, natural and/or oxy-acetylene gas)	1	2	3	4	5
46. Harden small metal parts with torch flame	1	2	3	4	5
47. Bronze weld ferrous metals	1	2	3	4	5
48. Soften, form and/or bend metal with flame	1	2	3	4	5
49. Arc weld (stick electrode) metal pieces in flat, horizontal and verticle-up positions	1	2	3	4	5
50. Arc weld (stick electrode) metal pieces in the overhead position	1	2	3	4	5
51. Safely extinguish fires	1	2	3	4	5
52. Lead soldering (sheet metal)	1	2	3	4	5
53. Fuel gas - under water cutting	1	2	3	4	5

IV. Welding Tasks - cont.

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5. AE - Absolutely Essential
4. VI - Very Important
3. INE - Important, but Not Essential
2. MI - Moderately Important
1. U - Unimportant

	<u>U</u>	<u>MI</u>	<u>INE</u>	<u>VI</u>	<u>AE</u>
54. Clean and maintain welding area	1	2	3	4	5
55. Repair welding and cutting equipment	1	2	3	4	5
56. Keep records on jobs completed	1	2	3	4	5
57. Get along with fellow employees	1	2	3	4	5
58. Communicate with fellow employees (written and oral)	1	2	3	4	5
59. Treat minor injuries (first aid)	1	2	3	4	5
60. Store supplies	1	2	3	4	5
Set-up, adjust and operate according to workorder, blueprint, layout and operating chart the followings:					
61. Hardness testing equipment	1	2	3	4	5
62. Dye penetration equipment	1	2	3	4	5
63. Magnaflux equipment	1	2	3	4	5
64. Tensile testing equipment	1	2	3	4	5
65. Abrasive cutting wheel equipment	1	2	3	4	5
66. Punch press equipment	1	2	3	4	5
67. Rolling equipment	1	2	3	4	5
68. Blast cleaning equipment	1	2	3	4	5
69. Polishing equipment	1	2	3	4	5
70. Drilling equipment	1	2	3	4	5
71. Arc welding equipment	1	2	3	4	5
72. Flame cutting equipment	1	2	3	4	5
73. Turntable equipment	1	2	3	4	5
74. Forge hot metal (hammer - manually)	1	2	3	4	5
75. Read a vernier	1	2	3	4	5
76. Prepare finished parts and assemblies for shipment (count parts, compare quantity and identification numbers of items with order number, etc.)	1	2	3	4	5
77. Inventory (help with annual plant inventory)	1	2	3	4	5
78. Load and unload items and assemblies for shipment and receiving (trucks, cars, etc.)	1	2	3	4	5
79. Other: _____	1	2	3	4	5
80. Other: _____	1	2	3	4	5
81. Other: _____	1	2	3	4	5
82. Other: _____	1	2	3	4	5
83. Other: _____	1	2	3	4	5
84. Other: _____	1	2	3	4	5
85. Other: _____	1	2	3	4	5

APPENDIX F

This appendix contains a copy of the rough draft revised using the recommendations obtained from a pre-pilot group.

A WELDING SURVEY OF THE BLACKHAWK TECHNICAL INSTITUTE INDUSTRIES
(UP-DATING THE WELDING CURRICULUM)

INSTRUMENTATION
PROJECT

by

Gerald E. Lesch



BLACKHAWK TECHNICAL INSTITUTE

VOCATIONAL, TECHNICAL AND ADULT EDUCATION DISTRICT FIVE 102

SERVING ROCK AND GREEN COUNTIES

February 20, 1973

O. L. JOHNSON
District Director

BELOIT CAMPUS
1149 Fourth Street
Beloit, Wisconsin 53511
1-608-365-6663

Dear Sir:

The Welding Department at Blackhawk Tech is conducting a research survey to assess the current employment trends, educational skills and competencies weldors should possess upon being employed in the welding establishments of the District. Since your firm is one of the industrial plants in the area employing weldors, you can help us in updating the Welding Program to meet your needs.

The study is being undertaken to identify:

- (1) The trends and hiring policies of the welding industries in Rock and Green counties.
- (2) The tools and equipment a beginning weldor should purchase upon being employed in your department.
- (3) The kinds of welding processes, their importance and future trends, presently being used in the District's welding firms.
- (4) The professional ratings of the tasks industry feels beginning weldors should know and be able to perform upon being employed in your department.

Since it is extremely important that all of the welding industries in the District be represented in this study, I have asked Mr. Richard Oster, T & I Division Chairman and Mr. Harold Thomas, T & I Special Programs Coordinator to assist me in administering this survey.

There are four sections in the attached survey. Each section is so devised that in most instances you can check (✓) or circle (O) your responses. If you need to guess on any item, please estimate your response as accurately as possible.

Your responses will be summarized with those of other welding firms. Neither you nor your firm will be identified with specific responses.

This study has been approved by the District Board of Blackhawk Tech along with the Welding Advisory Committee.

We, at Blackhawk Tech, recognize your expertise in the welding field and wish to thank you for your attention to this request.

Sincerely yours,

Advisory Committee Members

G. E. Lesch
Gerald E. Lesch
Welding Instructor

GEL/lw

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(UP-DATING THE WELDING CURRICULUM)

RATIONALE FOR STUDY

Curriculum revision movements are underway today in nearly all subject areas being taught in the vocational, technical institutes. This is because of the dynamic technological and scientific advances being made from day to day in all areas of industry. In the welding industry alone new discoveries and techniques are being disclosed daily. Information concerning them must be made available to the schools if they are going to continue to teach the skills and knowledges students should possess for employment. The failure to get this information from industry will only widen an already existing gap and force them to set up their own specialized training courses. Several factories (Fairbanks Morse, Beloit Corporation, etc.) have already considered initiating such courses in their plants. This thinking can only be reversed when school officials and program instructors get together with various industrial representatives to discuss and exchange information that is pertinent to each others particular needs.

Mr. M. J. Davis, supervisor of the training program at the Central Electric Company, indicates the need for educational institutions and industry to get together and exchange information with one another by stating:

Since industry is one of the principle customers for the end product of a school system and is vitally interested in the abilities and potential of the product, it seems only logical that industry should play a leading role in closing that gap.

In Rock and Green counties the industries are more than willing to exchange ideas and information with school officials and program instructors at the Blackhawk Technical Institute - District No. five, Beloit, Wisconsin. It is through this exchange of information that the one-year vocational welding program in District No. five is continuously being up-dated. Yet every year the local industries of Rock and Green counties ask for weldors who are qualified and competent to perform modern welding tasks. It is in

¹M. J. Davis "Closing the Education-Industry Interface Gap," Technical Educational News, (January - February 1970), P. 7.

²The term "weldor" as related to this study means: The person or operator who makes welds or operates welding equipment.

the light of these things that the one-year vocational welding program in District No. five is being up-dated.

It is hoped that by up-dating the welding program the following goals will be met:

- (1) To educate students as individuals, by considering individual needs and interests as they relate to his or her particular field.
- (2) To be able to prepare the students for gainful employment.
- (3) To be able to provide the opportunities for the up-grading of employees.
- (4) To be able to provide the students with skills for improving and up-grading their employment opportunities.
- (5) To recruit and motivate people to enroll in the welding program.
- (6) To develop in students an acceptable work attitude towards the welding field.
- (7) To enrich a students knowledges and skills in a chosen field of welding.
- (8) To provide a welding program which will be available to all interested members of the community.
- (9) To motivate students to extend themselves in their trade through independent research and/or study.
- (10) To prove to students that they have an important place in life, one with dignity, status and prestige in a job requiring an education of less than a baccalaureate degree.

If the welding program is to attain the above goals as well as the occupational preparation for welders and at the same time improve public relations between the school and local community it must employ those skills and competencies industry claims are essential for all welders to possess. Thus the purpose of this study is to survey the local welding industries in Rock and Green counties to determine the professional ratings of the tasks a beginning welder must be able to perform for employment. It is also intended that this study will give realistic opinions and suggestions on equipment and tools required for employment along with industrial trends and hiring policies.

*Note: A follow-up study pertaining to this survey will be conducted approximately 1 - 2 years later.

TABLE OF SPECIFICATIONS

OBJECTIVES:

- (1) To identify the trends and hiring policies of the welding industries in Rock and Green counties.
- (2) To identify the tools and equipment a beginning weldor should purchase upon being employed in the welding firms in Rock and Green counties.
- (3) To identify the kinds of welding processes, their magnitude ratings and future trends, presently being used in the welding establishments in Rock and Green counties.
- (4) To identify the professional ratings of the tasks industry feels beginning weldors should know and be able to perform upon being employed in the welding plants in Rock and Green counties.

INSTRUMENT ITEMS:

Section I
Items 1 - 18

Section II - No. 19
Items 1 - 33

Section III - No. 20
Items 1 - 16

Section IV - No. 21
Items 1 - 87

DEFINITION OF TERMS

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1. Air Carbon Arc Cutting (AAC) - An arc-cutting process wherein the severing of metal is effected by melting with the heat of an arc between an electrode and the base metal and an air stream is used to facilitate cutting.
2. Beginning Weldor - One who is still learning the basic skills and competencies of the welding trade. It is assumed that the person has very little, if any, industrial welding experience.
3. Flux-Core-Gas Shielded Metal Arc Welding (FCAW) - A flux cored wire arc welding (MIG) process wherein coalescence is produced by heating with an arc, between a continuous filler metal (consumable) electrode and the work.
4. Flux Shielded Metal Electrode Arc Welding (SMAW) - An arc welding process wherein coalescence is produced by heating with an arc between a covered metal electrode and the work. (Stick electrode welding)
5. Inert Gas Shielded Metal Arc Welding (GMAW) - A solid wire MIG electric arc welding process wherein coalescence is produced by heating with an arc between a continuous filler metal (consumable) electrode and the work.
6. Plasma-Arc Cutting (PAC) - An electric arc cutting process wherein severing of the metal is obtained by melting a localized area with a constricted arc and removing the molten material with a high velocity jet of hot, ionized gas issuing from the orifice.
7. Plasma-Arc Welding (PAW) - An arc welding process wherein coalescence is produced by heating with a constricted arc between an electrode and the work piece or the electrode and the constricting nozzle.
8. Stud Welding (SW) - An arc welding process wherein coalescence is produced by heating with an electric arc drawn between a metal stud, or similar part, and the other work part until the surfaces to be joined are properly heated, when they are brought together under pressure. Partial shielding may be obtained by the use of a ceramic ferrule surrounding the stud.
9. Submerged Arc Welding (SAW) - An arc-welding process wherein coalescence is produced by heating with an arc or arcs between a bare metal electrode or electrodes and the work. The arc is shielded by a blanket of granular, fusible material on the work. Pressure is not used and filler metal is obtained from the electrode and sometimes from a supplementary welding rod.
10. Welder - The welding equipment a weldor (person) uses.
11. Weldor - The person operating welding equipment. One whose job is mainly welding, or one who is capable of performing a manual or semiautomatic welding operation. If the job requires that he or she do set-up work and tacking operations according to blueprints, layouts, work orders, and operating charts they may be known as "Set-up Weldors". Set-up weldors generally set up and tack parts and/or pieces together into a finished assembly for a weldor to then weld.
12. Weldor Certification - Certification in writing that a weldor has produced welds meeting prescribed standards.

Gerald E. Lesch
August 10, 1973
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BLACKHAWK VOCATIONAL TECHNICAL SCHOOL

Vocational, Technical and Adult Education - District Five

Serving Rock and Green Counties

DIRECTIONS: Please fill in the information requested or mark (✓) the appropriate response. The list of definitions included with this form is for your reference. Information will be handled in a strictly confidential manner and therefore you will not be identified with your responses in our report. Feel free to be candid in your responses.

I. Employment Information

1. Company Name: _____
2. Address: _____ Zip: _____
3. Title: _____ Date: _____
4. What are your minimum formal education requirements for hiring a beginning weldor?
(✓ appropriate response)

_____ 1. Grade School	_____ 5. 2 Years College
_____ 2. High School	_____ 6. 4 Years College
_____ 3. 1 year Post High School	_____ 7. Other: _____
_____ 4. 2 Years Post High School	
- Does your department hire inexperienced weldors? 1. _____ Yes, 2. _____ No
5. If the answer to question (4) is "Yes", please indicate the average plant hours your department spends in training a beginning weldor? _____
6. If the answer to question (4) is "No", please indicate your requirements regarding the training experiences for inexperienced beginning weldors? _____
7. Which statement best describes the employment of weldors in your department in the next five years? (✓ appropriate response)

_____ 1. Increase	_____ 2. Decrease	_____ 3. Impossible To Tell
-------------------	-------------------	-----------------------------
8. Does your department plan to hire additional weldors next year? . 1. _____ Yes, 2. _____ No
9. Would you consider employing 1 year vocationally trained weldors? 1. _____ Yes, 2. _____ No
10. Does your plant have its own facilities for testing and licensing weldors? 1. _____ Yes, 2. _____ No
11. Does your department require its weldors to be licensed? 1. _____ Yes, 2. _____ No
12. If the answer to question (11) is "Yes", please indicate the type of certification license required? (✓ appropriate response)

_____ 1. United States Navy (USN)	_____ 5. American Society of Testing Materials (ASTM)
_____ 2. American Society of Mechanical Engineers (ASME)	_____ 6. Other: _____
_____ 3. American Welding Society (AWS)	
_____ 4. Society of Automotive Engineers (SAE)	_____ 7. Other: _____

14. What is the current number of weldors employed in your department? _____
15. What is the average hourly wage for beginning weldors in your department? ¹⁰⁸ _____
16. What is the average number of vacancies that occur in your welding department during a given year? _____

17. What periodicals, magazines, and books do you feel beginning weldors should read? (✓appropriate responses)

- ____ 1. Welding Journal
 ____ 2. Welding Engineer
 ____ 3. Welding Design And Fabrication
 ____ 4. Lincoln's Stabilizer

- ____ 5. Welder's Digest
 ____ 6. Welding Data Book
 ____ 7. Other: _____
 ____ 8. Other: _____

18. In the space provided below, please list and briefly describe any special alloys frequently welded in your shop? (After you have listed these please go on to Section II.)

Special Materials (metals - alloys) Welded In Your Department	Welding Processes Used
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DIRECTIONS: Listed below are tools and equipment used by weldors on the job. Read each item and determine which of them you feel beginning weldors (vocationally trained) should purchase when being employed in your welding department. If you feel there are other tools or equipment that beginning weldors should purchase for employment, please list them in the spaces labeled as "other" and rate them according to their importance. Circle the number on the right representing your response. Please review the rating codes given below.

1. = NU - Not Used, 2. = N - Nice to Have, 3. = E - Essential, 4. = CP - Company Provided

Tools:	Weldors				Set-Up Weldors			
	NU	N	E	CP	NU	N	E	CP
1. Vise Grips	1	2	3	4	1	2	3	4
2. Two Foot Carpenter Square	1	2	3	4	1	2	3	4
3. Small "C" Clamps (Assorted Sizes)	1	2	3	4	1	2	3	4
4. Level (12" to 36" length)	1	2	3	4	1	2	3	4
5. Adjustable Wrench (10" or 12")	1	2	3	4	1	2	3	4
6. Chalk Line	1	2	3	4	1	2	3	4
7. Center Punches (Small and Large)	1	2	3	4	1	2	3	4
8. Chipping Hammer (Slag)	1	2	3	4	1	2	3	4
9. Combination Steel Square (Complete Set)	1	2	3	4	1	2	3	4
10. Micrometer (0" to 1")	1	2	3	4	1	2	3	4
11. Hammer (16 oz. and/or 40 oz.)	1	2	3	4	1	2	3	4
12. Combination Slip Joint Pliers (6" or 10")	1	2	3	4	1	2	3	4
13. Scratch Awl	1	2	3	4	1	2	3	4
14. Steel Scale (Pocket Size - 6")	1	2	3	4	1	2	3	4
15. Trammel Points	1	2	3	4	1	2	3	4
16. Hand Wire Brush	1	2	3	4	1	2	3	4
Personal Protective Equipment:								
17. Safety Leggings	1	2	3	4	1	2	3	4
18. Safety Apron	1	2	3	4	1	2	3	4
19. Safety Gloves	1	2	3	4	1	2	3	4
20. Safety Glasses	1	2	3	4	1	2	3	4
21. Face Shield	1	2	3	4	1	2	3	4
22. Welding Helmet	1	2	3	4	1	2	3	4
23. Welding Lens	1	2	3	4	1	2	3	4
24. Safety Shoes	1	2	3	4	1	2	3	4
25. Other: _____	1	2	3	4	1	2	3	4
Steel Tape:								
26. 10 Foot	1	2	3	4	1	2	3	4
27. 15 Foot	1	2	3	4	1	2	3	4
28. 20 Foot	1	2	3	4	1	2	3	4
29. 50 Foot	1	2	3	4	1	2	3	4
30. Other: _____	1	2	3	4	1	2	3	4
31. Other: _____	1	2	3	4	1	2	3	4
32. Other: _____	1	2	3	4	1	2	3	4

III. Welding Processes

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DIRECTIONS: Listed below are several welding processes. These processes were selected on their frequent occurrence based on my contacts with welding supervisors, foremen, engineers and welding instructors in Wisconsin. Rate the importance of each welding process to the welding shop in your shop and estimate the trend for its use over the next five years. In this section you will make two responses to each item. Please circle your responses. If you employ welding processes that have been omitted, please list them in the spaces labeled as "other" and rate their importance and the trend for their use over the next five years. A list of definitions is included in this form for your reference. Please review the rating codes given below.

Importance Ratings:

5. EI - Extremely Important (Used Daily)
4. VI - Very Important (Used Weekly)
3. I - Important (Used Monthly)
2. MI - Moderately Important (Used once/year)
1. U - Unimportant (Not used)

Trend Rating:

5. RI - Rapid Increase
4. MI - Moderate Increase
3. SS - Stay the Same
2. MD - Moderate Decrease
1. RD - Rapid Decrease

Welding Processes:	Present Use - Importance Ratings:					Future Use - Trend Ratings:				
	<u>U</u>	<u>MI</u>	<u>I</u>	<u>VI</u>	<u>EI</u>	<u>RD</u>	<u>MD</u>	<u>SS</u>	<u>MI</u>	<u>RI</u>
1. Air Carbon Arc Cutting (CAC)	1	2	3	4	5	1	2	3	4	5
2. Braze Welding	1	2	3	4	5	1	2	3	4	5
3. Flux-Core-Gas Shielded Metal Arc Welding (FCAW)	1	2	3	4	5	1	2	3	4	5
4. Flux Shielded Metal Electrode Arc Welding (SMAW)	1	2	3	4	5	1	2	3	4	5
5. Inert Gas Shielded Metal Arc Welding (GMAW)	1	2	3	4	5	1	2	3	4	5
6. Inert Gas Shielded Tungsten Arc Welding (TIG)	1	2	3	4	5	1	2	3	4	5
7. Oxy-Acetylene Welding (OAW)	1	2	3	4	5	1	2	3	4	5
8. Oxy - Fuel Gas Cutting (OFC)	1	2	3	4	5	1	2	3	4	5
9. Plasma Arc Cutting (PAC)	1	2	3	4	5	1	2	3	4	5
10. Plasma Arc Welding (PAW)	1	2	3	4	5	1	2	3	4	5
11. Submerged Arc Welding (SAW)	1	2	3	4	5	1	2	3	4	5
12. Resistance-Spot Welding (RSW)	1	2	3	4	5	1	2	3	4	5
13. Stud Welding (SW)	1	2	3	4	5	1	2	3	4	5
14. Other: _____	1	2	3	4	5	1	2	3	4	5
15. Other: _____	1	2	3	4	5	1	2	3	4	5
16. Other: _____	1	2	3	4	5	1	2	3	4	5

DIRECTIONS: Listed below are a variety of welding tasks performed by weldors in industry. Read each task and determine which of them a beginning weldor should know and be able to perform upon being employed in your department. Rate the importance of each task by circling the appropriate number on the right representing your response. If you feel certain tasks have been omitted, please list them in the spaces labeled as "other" and rate their importance. A list of definitions is included in this form for your reference. Please review the rating codes given below.

5. EI - Extremely Important (Perform Task Without Supervision)
 4. VI - Very Important
 3. I - Important (Perform Task With Supervision)
 2. MI - Moderately Important
 1. U - Unimportant (Does Not Perform The Task)

	<u>U</u>	<u>MI</u>	<u>I</u>	<u>VI</u>	<u>EI</u>
1. Build jigs and fixtures for holding metal parts preparatory to welding	1	2	3	4	5
2. Silver braze and/or solder ferrous and nonferrous metals	1	2	3	4	5
3. Make patterns and/or templates for cutting, forming, and bending plates and pipe	1	2	3	4	5
4. Estimate cost of welding joints	1	2	3	4	5
5. Control distortion when cutting and welding	1	2	3	4	5
6. Drive and operate forklift	1	2	3	4	5
7. Maintain welding and cutting equipment (repair or replace broken parts)	1	2	3	4	5
8. Test pressure hoses for leaks	1	2	3	4	5
9. Measure parts with calipers and dividers	1	2	3	4	5
10. Form and crimp metal (hand tools - manually)	1	2	3	4	5
11. Tap holes that have been drilled in metal (hand tools - not power driven)	1	2	3	4	5
12. Tap holes that have been drilled in metal (power driven equipment)	1	2	3	4	5
13. Clean and/or degrease work pieces using wire brush and grinder	1	2	3	4	5
14. Clean and/or degrease work pieces using chemical solutions	1	2	3	4	5
15. Clean and polish welds using grinder and chipper	1	2	3	4	5
16. Heat metal product preparatory to welding	1	2	3	4	5
17. Position, clamp and assemble work pieces in (figs) and fixtures	1	2	3	4	5
18. Tack weld assemblies together in all positions	1	2	3	4	5
19. Saw metal (manually)	1	2	3	4	5
20. Saw metal (machine)	1	2	3	4	5
21. File metal (manually)	1	2	3	4	5
22. File metal (machine)	1	2	3	4	5
23. Read and use a micrometer	1	2	3	4	5
24. Layout and prepare metal joints, parts or products preparatory to welding	1	2	3	4	5

IV. Welding Tasks - cont.

5. EI - Extremely Important (Perform Task Without Supervision)
4. VI - Very Important
3. I - Important (Perform Task With Supervision)
2. MI - Moderately Important
1. U - Unimportant (Does Not Perform The Task)

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	<u>U</u>	<u>MI</u>	<u>I</u>	<u>VI</u>	<u>EI</u>
25. Sharpen drills (manually)	1	2	3	4	5
26. Sharpen drills (machine)	1	2	3	4	5
27. Spray paint metal products	1	2	3	4	5
28. Attach grappling equipment (hooks, clamps, etc.) to objects preparatory to movement by <u>self</u>	1	2	3	4	5
29. Attach grappling equipment (hooks, clamps, etc.) to objects preparatory to movement by somebody else	1	2	3	4	5
30. Order supplies	1	2	3	4	5
31. Assemble parts by bolting and riveting	1	2	3	4	5
32. Dress resistance spot welder copper electrode tips	1	2	3	4	5
33. Straighten metal with flame	1	2	3	4	5
34. Straighten metal with straightening press	1	2	3	4	5
35. Shear metal (hand tools - manually)	1	2	3	4	5
36. Flame cut steel plate or structural shapes using mapp gas	1	2	3	4	5
37. Flame cut steel plate or structural shapes using natural gas	1	2	3	4	5
38. Flame cut steel plate or structural shapes using oxy-acetylene gas	1	2	3	4	5
39. Cut metal - machine power nibbler	1	2	3	4	5
40. Carbon arc welding (repair)	1	2	3	4	5
41. Carbon arc welding (production)	1	2	3	4	5
42. Case harden metals	1	2	3	4	5
43. Air carbon arc cutting and gouging	1	2	3	4	5
44. Gouging with flame (mapp, natural and/or oxy-acetylene gas)	1	2	3	4	5
45. Harden small metal parts with torch flame	1	2	3	4	5
46. Bronze weld ferrous metals	1	2	3	4	5
47. Soften, form and/or bend metal with flame	1	2	3	4	5
48. Arc weld (stick electrode) metal pieces in flat, horizontal and verticle-up position	1	2	3	4	5
49. Arc weld (stick electrode) metal pieces in the overhead position	1	2	3	4	5
50. Safely extinguish fires	1	2	3	4	5
51. Lead soldering (sheet metal)	1	2	3	4	5
52. Fuel gas - under water cutting	1	2	3	4	5
53. Follow directions given by signals (Auditory and Visual)	1	2	3	4	5
54. Clean and maintain welding area	1	2	3	4	5
55. Repair welding and cutting equipment	1	2	3	4	5

IV. Welding Tasks - Cont.

5. EI - Extremely Important (Perform Task Without Supervisor)
 4. VI - Very Important
 3. I - Important (Perform Task With Supervision)
 2. MI - Moderately Important
 1. U - Unimportant (Does Not Perform The Task)

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	<u>U</u>	<u>MI</u>	<u>I</u>	<u>VI</u>	<u>EI</u>
56. Keep records of jobs completed	1	2	3	4	5
57. Get along with fellow employees	1	2	3	4	5
58. Communicate with fellow employees (written and oral)	1	2	3	4	5
59. Treat <u>minor</u> (first aid) injuries	1	2	3	4	5
60. Store supplies	1	2	3	4	5
Set-up, adjust and operate according to work order, blueprint, layout and operating chart the following:					
61. Hardness testing equipment	1	2	3	4	5
62. Dye penetration equipment	1	2	3	4	5
63. Magnaflux equipment	1	2	3	4	5
64. Tensile testing equipment	1	2	3	4	5
65. Abrasive cutting wheel equipment	1	2	3	4	5
66. Punch press equipment	1	2	3	4	5
67. Rolling equipment	1	2	3	4	5
68. Blast cleaning equipment	1	2	3	4	5
69. Fine polishing equipment	1	2	3	4	5
70. Drilling equipment	1	2	3	4	5
71. Commonly used arc welding equipment	1	2	3	4	5
72. Gas fuel cutting equipment	1	2	3	4	5
73. Turntable equipment	1	2	3	4	5
74. Power shearing equipment	1	2	3	4	5
75. Other:	1	2	3	4	5
76. Other:	1	2	3	4	5
77. Forge hot metal (hammer - manually).	1	2	3	4	5
78. Read a vernier	1	2	3	4	5
79. Prepare finished parts and assemblies for shipment (count parts, compare quantity and identification numbers of items with order number, etc.)	1	2	3	4	5
80. Inventory (help with annual shop inventory)	1	2	3	4	5
81. Compute simple mathematical problems related to metal fabrication and repair	1	2	3	4	5
82. Keep accurate time reports (How long it takes to weld, cut, etc.)	1	2	3	4	5
83. Hand punch or drill holes in sheet metal preparatory to riveting	1	2	3	4	5
84. Prepare a personal data sheet to present with the job application form	1	2	3	4	5
85. Other:	1	2	3	4	5
86. Other:	1	2	3	4	5
87. Other:	1	2	3	4	5

APPENDIX G

This appendix contains a copy of the forward, follow-up letter, and minutes of the first welding advisory committee meeting.



BLACKHAWK TECHNICAL INSTITUTE

VOCATIONAL, TECHNICAL AND ADULT EDUCATION DISTRICT FIVE

115

SERVING ROCK AND GREEN COUNTIES

O. L. JOHNSON
District Director

November 7, 1973

BELOIT CAMPUS
1149 Fourth Street
Beloit, Wisconsin 53511
1-608-361-6663

To:

From: Gerald E. Lesch
Welding Instructor

Subject: Welding Advisory Committee Meeting Agenda

Dear Sir:

The first 1973-74 School Year Welding Advisory Committee meeting has been scheduled for Thursday, November 15, 1973, at the Blackhawk Technical Institute, Beloit Campus, at 7:30 P.M., Room 208.

The agenda follows:

1. Introduction of Members
2. Explanation of duties and functions of the committee
3. Tour of the Welding Shop (Beloit Campus)
4. Information on New Facilities
5. Review of present Welding Curriculum
6. Explanation of a welding survey
7. Election of officers (Chairman, Vice-chairman, and Recording Secretary)
8. Date for next meeting
9. Other business

We indeed hope that you will make every effort to attend this important meeting. Your cooperation, suggestions, and information supplied will contribute greatly to the improvement of our instruction in which we all share a great interest. Please let us know in advance if you cannot attend. (Phone 365-6663) Refreshments will be served.

Sincerely yours,

Gerald E. Lesch,
Welding Instructor

GEL:ah

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BLACKHAWK TECHNICAL INSTITUTE

O. L. Johnson, District Director

Subject: Welding Advisory Committee Meeting Minutes

Date: November 15, 1973

Attendance: Gerald Lesch, Richard Oster, Francis
Boigenzahn, Louis Heinze and Phil Hamilton

The meeting began with an introduction of members given by Mr. Lesch. Mr. Oster explained the functions and duties of advisory committees prescribed by state law. Some of these are as follows:

- (a) Act as recommending group making recommendations to Student Services Department and/or Director's office.
- (b) Review curriculum at least once a year.
- (c) Help in the selection of apprentices.
- (d) Review instructional materials.
- (e) Help select honor graduates.
- (f) Recommend the purchase of new equipment if needed.
- (g) Cooperate with the various state organizations.
- (h) Cooperate with the various state committees.
- (i) Committee used by School Director for advise and clarification of problems pertaining to the welding trade.

Mr. Oster stated that there are about 85 members that make up the Advisory Committees in the various trades at Blackhawk Tech. It is hopeful in the near future to hold a meeting with all Trade Advisory Committee members present.

New Facilities

Mr. Oster presented the plans for the new buildings now being built on the site chosen between Beloit and Janesville. The floor plans of the Weldry were discussed in detail by Mr. Lesch.

Review of Present Welding Curriculum

Mr. Lesch presented his present curriculum by giving each member present copies of some of the instructional materials used in his classes.

Other materials presented and discussed consisted of the following:

- (a) Safety Handbook - For Student Use
- (b) Arc Welding Symbols - Program of Self Study
- (c) Basic Arc Welding Workbook
- (d) Airco Electrode Handbook
- (e) Basic Oxyacetylene Workbook
- (f) Basic Tig and Mig Workbook
- (g) Pipe Welding Techniques Workbook

- (h) Types of Rods Used
(1/3" Electrodes)
- (1) 7824
 - (2) 8011
 - (3) 308-Stainless
 - (4) Rex R-65
 - (5) 7014
 - (6) 6020
 - (7) 7016
 - (8) 6013
 - (9) Others

(It was pointed out that the shop is now equipped to do apray welding).

Explanation of Welding Survey was presented by Mr. Lesch. The committee members were given a copy (rough Draft) of a Welding Survey presently being set up by Mr. Lesch for the purpose of gathering from the welding industires in District 5 statistical data, which will be used to up-date the one-year welding curriculum. The committee was informed that they would have the final say as to how the survey instruments would be set up and that they should evaluate the survey and make any necessary revisions. The members were asked to present at the next committee meeting, their pros and cons concerning the survey so that any necessary changes can be made before the final draft goes in for approval.

The committee members present suggested that the next Advisory Meeting be either the first or second Thursday in the month of January. The meeting date will be announced later.

Recorder:
Fran Beogenzahn



BLACKHAWK TECHNICAL INSTITUTE

VOCATIONAL, TECHNICAL AND ADULT EDUCATION DISTRICT FIVE

SERVING ROCK AND GREEN COUNTIES

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O. L. JOHNSON
District Director

BELOIT CAMPUS
1149 Fourth Street
Beloit, Wisconsin 53511
1-608-365-6663

TO: Welding Advisory Committee Members
FROM: Gerald E. Lesch
Welding Instructor
RE: Welding Advisory Committee Results
DATE: December 6, 1973

Thank you for attending our first 1973-74 school year Welding Advisory Committee Meeting held Thursday, November 15, 1973 at the Blackhawk Technical Institute, Beloit Campus. (Sorry a few of you could not attend)

Enclosed you will find the minutes of the meeting along with a rough draft of a Welding Survey presently being set-up by myself for the purpose of up-dating the One-year Vocational Diploma Welding Program at our school.

Will you please study carefully the survey instruments and make notes concerning any necessary revisions you feel will help to make this survey a success. Your suggestions should be presented to the committee for approval and/or disapproval at our next meeting -- date not yet announced. The committee will, at this meeting, develop, formulate and approve the final draft of the survey instruments.

Thank you for your assistance. If you have any questions, please call me at 365-6663.

APPENDIX H

This appendix contains a copy of the forward letter and minutes of the second welding Advisory Committee meeting.



BLACKHAWK TECHNICAL INSTITUTE

VOCATIONAL, TECHNICAL AND ADULT EDUCATION DISTRICT FIVE
120

SERVING ROCK AND GREEN COUNTIES

O. L. JOHNSON
District Director

BELOIT CAMPUS
1149 Fourth Street
Beloit, Wisconsin 53511
1-608-365-6663

TO: Welding Advisory Committee Members
FROM: Gerald E. Lesch
Welding Instructor
RE: Welding Advisory Committee Meeting Agenda
DATE: December 21, 1973

Dear Sir:

The second 1973-74 school year Welding Advisory Committee Meeting has been scheduled for Thursday, January 10, 1974, at the Blackhawk Technical Institute, Beloit Campus, at 7:00 P.M.

The agenda follows:

1. Introduction of members.
2. Report on new facilities.
3. Welding Survey Review (Formulate and approve the final draft of the Welding Survey).
4. Committee recommendation - new equipment.
5. Election of officers.
6. Tour of shop.
7. Date for next meeting.
8. Other business.

We, indeed, hope that you will make every effort to attend this important meeting. Your cooperation, suggestions, and information supplied will contribute greatly to the improvement of our instruction, in which we all share a great interest. Please let us know in advance if you cannot attend. (Telephone 1-608-365-6663). Refreshments will be served.

WELDING ADVISORY COMMITTEE MEETING
January 10, 1974 - Beloit Campus

1. Mr. Lesch called the meeting to order at 7:15 p.m. and appointed Mr. Richard A. Oster as recorder.
2. PRESENT WERE: Messrs. Phil Hamilton, Leonard Ford, Robert Silvas, Gerald Lesch and Richard A. Oster.
3. After the introduction of committee members, Mr. Lesch asked for a report on the new facility. This building of the new facility is progressing according to schedule -- all steel will be in place by January 28, the panels will be in place by April 1, buildings will be enclosed by June 1, and buildings should be ready for occupancy by December 17.
4. The Welding Survey was discussed in detail. Mr. Lesch carefully explained the reasoning behind each section of the survey, what he hoped to accomplish, and the methods to be used in contacting industry. The committee recommended that each industry in Rock and Green Counties employing weldors be given a copy of the results of the survey. The survey was then reviewed item by item. The following suggestions were made:
 - (a) Include a question on minimum educational attainment for initial employment as a weldor.
 - (b) Include a box, between 1 & 2, for "stay the same."
 - (c) Include an item "None."
 - (d) Include in Section II, item 1-16, soap stone and alan wrenches.
 - (e) Correct spelling of "responses" in Section III.
 - (f) Add "Peen Straightening" to Section VI.

The committee approved the survey with corrections and additions by a consensus vote.

5. The need was discussed for two new Fluxrore MIG welding machines to replace the ones purchased with M.D.T.A. funds and transferred to another M.D.T.A. project August 21, 1973. After considerable discussion, it was moved, seconded and passed that the Advisory Committee recommend District 5 purchase two constant potential D.C., 200 amp, inert gas, MIG, arc welders complete with accessories under Federal Project #05-207-151-174.
6. Mr. Lesch called for election of a Chairman for 1974. Mr. Robert Silvis was nominated and elected.
7. Adjournment.

APPENDIX I

This appendix contains a copy of the final survey draft as approved by the Blackhawk Tech Welding Advisory Committee members.

A WELDING SURVEY OF THE BLACKHAWK TECHNICAL INSTITUTE INDUSTRIES 123
(UP-DATING THE WELDING CURRICULUM)

INSTRUMENTATION
PROJECT

by

Gerald E. Lesch

February 20, 1974

TABLE OF SPECIFICATIONS

OBJECTIVES:

- (1) To identify the trends and hiring policies of the welding industries in Rock and Green counties.
- (2) To identify the tools and equipment a beginning weldor should purchase upon being employed in the welding firms in Rock and Green counties.
- (3) To identify the kinds of welding processes, their magnitude ratings and future trends, presently being used in the welding establishments in Rock and Green counties.
- (4) To identify the professional ratings of the tasks industry feels beginning weldors should know and be able to perform upon being employed in the welding plants in Rock and Green counties.

INSTRUMENT ITEMS:

Section I
Items 1 - 19

Section II - No. 20
Items 1 - 34

Section III - No. 21
Items 1 - 16

Section IV - No. 22
Items 1 - 87

1. Air Carbon Arc Cutting (CAC) - An arc-cutting process wherein the severing of metal is effected by melting with the heat of an arc between an electrode and the base metal and an air stream is used to facilitate cutting.
2. Beginning Weldor - One who is still learning the basic skills and competencies of the welding trade. It is assumed that the person has very little, if any, industrial welding experience.
3. Flux-Core-Gas Shielded Metal Arc Welding (FCAW) - A flux cored wire arc welding (MIG) process wherein coalescence is produced by heating with an arc, between a continuous filler metal (consumable) electrode and the work.
4. Flux Shielded Metal Electrode Arc Welding (SMAW) - An arc welding process wherein coalescence is produced by heating with an arc between a covered metal electrode and the work. (Stick electrode welding)
5. Inert Gas Shielded Metal Arc Welding (GMAW) - A solid wire MIG electric arc welding process wherein coalescence is produced by heating with an arc between a continuous filler metal (consumable) electrode and the work.
6. Plasma-Arc Cutting (PAC) - An electric arc cutting process wherein severing of the metal is obtained by melting a localized area with a constricted arc and removing the molten material with a high velocity jet of hot, ionized gas issuing from the orifice.
7. Plasma-Arc Welding (PAW) - An arc welding process wherein coalescence is produced by heating with a constricted arc between an electrode and the work piece or the electrode and the constricting nozzle.
8. Stud Welding (SW) - An arc welding process wherein coalescence is produced by heating with an electric arc drawn between a metal stud, or similar part, and the other work part until the surfaces to be joined are properly heated, when they are brought together under pressure. Partial shielding may be obtained by the use of a ceramic ferrule surrounding the stud.
9. Submerged Arc Welding (SAW) - An arc-welding process wherein coalescence is produced by heating with an arc or arcs between a bare metal electrode or electrodes and the work. The arc is shielded by a blanket of granular, fusible material on the work. Pressure is not used and filler metal is obtained from the electrode and sometimes from a supplementary welding rod.
10. Welder - The welding equipment a weldor (person) uses.
11. Weldor - The person operating welding equipment. One whose job is mainly welding, or one who is capable of performing a manual or semi-automatic welding operation. If the job requires that he or she do set-up work and tacking operations according to blueprints, layouts, work orders, and operating charts they may be known as "Set-up Weldors". Set-up weldors generally set up and tack parts and/or pieces together into a finished assembly for a weldor to then weld.
12. Weldor Certification - Certification in writing that a weldor has produced welds meeting prescribed standards.

Definitions numbered 1, 2, 3, 4, 5, 6, 7, 8, 9, and 12 were obtained from: Arthur L. Phillips (ed.), Welding Handbook: Welding Processes - Section Two (Sixth Edition; New York: American Welding Society, 1969), Appendices 10 - 57.

Vocational, Technical and Adult Education - District Five
Serving Rock and Green Counties

DIRECTIONS: Please fill in the information requested or mark (✓) the appropriate response. The list of definitions included with this form is for your reference. Information will be handled in a strictly confidential manner and therefore you will not be identified with your responses in our report. Feel free to be candid in your responses.

I. Employment Information

1. Company Name: _____ Date: _____
2. Address: _____ Zip: _____
3. Name: _____ Title: _____
4. Does your department have any minimum formal education requirements for hiring beginning weldors? 1. ☐ Yes, 2. ☐ No
5. If the answer to question (4) is "Yes", please indicate the minimum formal educational requirement(s)? _____
6. Does your department hire inexperienced weldors? 1. ☐ Yes, 2. ☐ No
7. If the answer to question (6) is "Yes", please indicate the average plant hours your department spends in training a beginning weldor? _____
- If the answer to question (6) is "No", please indicate your requirements regarding the training experiences for inexperienced beginning weldors?

-
9. Which statement best describes the employment of weldors in your department in the next five years? (✓ appropriate response)
- ____ 1. Increase ____ 2. Stay The Same ____ 3. Decrease ____ 4. Impossible To Tell
10. Does your department plan to hire additional weldors next year? . 1. ☐ Yes, 2. ☐ No
11. Would you consider employing 1 year vocationally trained weldors? 1. ☐ Yes, 2. ☐ No
12. Does your plant have its own facilities for testing and licensing weldors? 1. ☐ Yes, 2. ☐ No
13. Does your department require its weldors to be licensed? 1. ☐ Yes, 2. ☐ No
14. If the answer to question (13) is "Yes", please indicate the type of certification license required? (✓ appropriate response)
- | | |
|---|--|
| ____ 1. United States Navy (USN) | ____ 5. American Society of Testing Materials (ASTM) |
| ____ 2. American Society of Mechanical Engineers (ASME) | ____ 6. Other: _____ |
| ____ 3. American Welding Society (AWS) | _____ |
| ____ 4. Society of Automotive Engineers (SAE) | ____ 7. Other: _____ |

DIRECTIONS: Listed below are tools and equipment used by weldors on the job. Read each item and determine which of them you feel beginning weldors (vocationally trained) should purchase upon being employed in your welding department. If you feel there are other tools or equipment that beginning weldors should purchase for employment, please list them in the spaces labeled as "other" and rate them according to their importance. Circle the number on the right representing your response. Please review the rating codes given below.

1. = NU - Not Used, 2. = N - Nice to Have, 3. = E - Essential, 4. = CP - Company Provided

Tools:	Weldors				Set-Up Weldors			
	NU	N	E	CP	NU	N	E	CP
1. Vise Grips	1	2	3	4	1	2	3	4
2. Two Foot Carpenter Square	1	2	3	4	1	2	3	4
3. Small "C" Clamps (Assorted Sizes)	1	2	3	4	1	2	3	4
4. Level (12" to 36" length)	1	2	3	4	1	2	3	4
5. Adjustable Wrench (10" or 12")	1	2	3	4	1	2	3	4
6. Chalk Line	1	2	3	4	1	2	3	4
7. Center Punches (Small and Large)	1	2	3	4	1	2	3	4
8. Chipping Hammer (Slag)	1	2	3	4	1	2	3	4
9. Combination Steel Square (Complete Set)	1	2	3	4	1	2	3	4
10. Micrometer (0" to 1")	1	2	3	4	1	2	3	4
11. Hammer (16 oz. and/or 40 oz.)	1	2	3	4	1	2	3	4
12. Combination Slip Joint Pliers (6" or 10")	1	2	3	4	1	2	3	4
13. Scratch Awl	1	2	3	4	1	2	3	4
14. Steel Scale (Pocket Size - 6")	1	2	3	4	1	2	3	4
15. Trammel Points	1	2	3	4	1	2	3	4
16. Hand Wire Brush	1	2	3	4	1	2	3	4
17. Soap Stone	1	2	3	4	1	2	3	4
Personal Protective Equipment:								
18. Safety Legging	1	2	3	4	1	2	3	4
19. Safety Apron	1	2	3	4	1	2	3	4
20. Safety Gloves	1	2	3	4	1	2	3	4
21. Safety Glasses	1	2	3	4	1	2	3	4
22. Face Shield	1	2	3	4	1	2	3	4
23. Welding Helmet	1	2	3	4	1	2	3	4
24. Welding Lens	1	2	3	4	1	2	3	4
25. Safety Shoes	1	2	3	4	1	2	3	4
26. Other: _____	1	2	3	4	1	2	3	4
Steel Tape:								
27. 10 Foot	1	2	3	4	1	2	3	4
28. 15 Foot	1	2	3	4	1	2	3	4
29. 20 Foot	1	2	3	4	1	2	3	4
30. 50 Foot	1	2	3	4	1	2	3	4
31. Other: _____	1	2	3	4	1	2	3	4
32. Other: _____	1	2	3	4	1	2	3	4
33. Other: _____	1	2	3	4	1	2	3	4
34. Other: _____	1	2	3	4	1	2	3	4

DIRECTIONS: Listed below are several welding processes. These processes were selected on their frequent occurrence based on my contacts with welding supervisors, foremen, engineers and welding instructors in Wisconsin. Rate the importance of each welding process to the welding jobs in your shop and estimate the trend for its use over the next five years. In this section you will make two responses to each item. Please circle your responses. If you employ welding processes that have been omitted, please list them in the spaces labeled as "other" and rate their importance and the trend for their use over the next five years. A list of definitions is included in this form for your reference. Please review the rating codes given below.

Importance Ratings:

5. EI - Extremely Important (Used Daily)
 4. VI - Very Important (Used Weekly)
 3. I - Important (Used Monthly)
 2. MI - Moderately Important (Used once/year)
 1. U - Unimportant (Not used)

Trend Rating:

5. RI - Rapid Increase
 4. MI - Moderate Increase
 3. SS - Stay the Same
 2. MD - Moderate Decrease
 1. RD - Rapid Decrease

<u>Welding Processes:</u>	<u>Present Use -</u> <u>Importance Ratings:</u>					<u>Future Use -</u> <u>Trend Ratings:</u>				
	<u>U</u>	<u>MI</u>	<u>I</u>	<u>VI</u>	<u>EI</u>	<u>RD</u>	<u>MD</u>	<u>SS</u>	<u>MI</u>	<u>RI</u>
1. Air Carbon Arc Cutting (CAC)	1	2	3	4	5	1	2	3	4	5
2. Braze Welding	1	2	3	4	5	1	2	3	4	5
3. Flux-Core-Gas Shielded Metal Arc Welding (FCAW)	1	2	3	4	5	1	2	3	4	5
4. Flux Shielded Metal Electrode Arc Welding (SMAW)	1	2	3	4	5	1	2	3	4	5
5. Inert Gas Shielded Metal Arc Welding (GMAW)	1	2	3	4	5	1	2	3	4	5
6. Inert Gas Shielded Tungsten Arc Welding (TIG)	1	2	3	4	5	1	2	3	4	5
7. Oxy-Acetylene Welding (OAW)	1	2	3	4	5	1	2	3	4	5
8. Oxy - Fuel Gas Cutting (OFC)	1	2	3	4	5	1	2	3	4	5
9. Plasma Arc Cutting (PAC)	1	2	3	4	5	1	2	3	4	5
10. Plasma Arc Welding (PAW)	1	2	3	4	5	1	2	3	4	5
11. Submerged Arc Welding (SAW)	1	2	3	4	5	1	2	3	4	5
12. Resistance-Spot Welding (RSW)	1	2	3	4	5	1	2	3	4	5
13. Stud Welding (SW)	1	2	3	4	5	1	2	3	4	5
14. Other: _____	1	2	3	4	5	1	2	3	4	5
15. Other: _____	1	2	3	4	5	1	2	3	4	5
16. Other: _____	1	2	3	4	5	1	2	3	4	5

DIRECTIONS: Listed below are a variety of welding tasks performed by weldors in industry. Read each task and determine which of them a beginning weldor should know and be able to perform upon being employed in your department. Rate the importance of each task by circling the appropriate number on the right representing your response. If you feel certain tasks have been omitted, please list them in the spaces labeled as "other" and rate their importance. A list of definitions is included in this form for your reference. Please review the rating codes given below.

5. EI - Extremely Important (Perform Task Without Supervision)
 4. VI - Very Important
 3. I - Important (Perform Task With Supervision)
 2. MI - Moderately Important
 1. U - Unimportant (Does Not Perform The Task)

	<u>U</u>	<u>MI</u>	<u>I</u>	<u>VI</u>	<u>EI</u>
1. Build jigs and fixtures for holding metal parts preparatory to welding	1	2	3	4	5
2. Silver braze and/or solder ferrous and nonferrous metals	1	2	3	4	5
3. Make patterns and/or templates for cutting, forming, and bending plates and pipe	1	2	3	4	5
4. Estimate cost of welding joints	1	2	3	4	5
5. Control distortion when cutting and welding	1	2	3	4	5
6. Peen straightening	1	2	3	4	5
7. Maintain welding and cutting equipment (repair or replace broken parts)	1	2	3	4	5
8. Test pressure hoses for leaks	1	2	3	4	5
9. Measure parts with calipers and dividers	1	2	3	4	5
10. Form and crimp metal (hand tools - manually)	1	2	3	4	5
11. Tap holes that have been drilled in metal (hand tools - not power driven)	1	2	3	4	5
12. Tap holes that have been drilled in metal (power driven equipment)	1	2	3	4	5
13. Clean and/or degrease work pieces using wire brush and grinder	1	2	3	4	5
14. Clean and/or degrease work pieces using chemical solutions	1	2	3	4	5
15. Clean and polish welds using grinder and chipper	1	2	3	4	5
16. Heat metal product preparatory to welding	1	2	3	4	5
17. Position, clamp and assemble work pieces in jigs and fixtures	1	2	3	4	5
18. Tack weld assemblies together in all positions	1	2	3	4	5
19. Saw metal (manually)	1	2	3	4	5
20. Saw metal (machine)	1	2	3	4	5
21. File metal (manually)	1	2	3	4	5
22. File metal (machine)	1	2	3	4	5
23. Read and use a micrometer	1	2	3	4	5
24. Layout and prepare metal joints, parts or products preparatory to welding	1	2	3	4	5

5. EI - Extremely Important (Perform Task Without Supervision)
 4. VI - Very Important
 3. I - Important (Perform Task With Supervision)
 2. MI - Moderately Important
 1. U - Unimportant (Does Not Perform The Task)

	<u>U</u>	<u>MI</u>	<u>I</u>	<u>VI</u>	<u>EI</u>
25. Sharpen drills (manually)	1	2	3	4	5
26. Sharpen drills (machine)	1	2	3	4	5
27. Spray paint metal products	1	2	3	4	5
28. Attach grappling equipment (hooks, clamps, etc.) to objects preparatory to movement by <u>self</u>	1	2	3	4	5
29. Attach grappling equipment (hooks, clamps, etc.) to objects preparatory to movement by somebody else	1	2	3	4	5
30. Order supplies	1	2	3	4	5
31. Assemble parts by bolting and riveting	1	2	3	4	5
32. Dress resistance spot welder copper electrode tips	1	2	3	4	5
33. Straighten metal with flame	1	2	3	4	5
34. Straighten metal with straightening press	1	2	3	4	5
35. Shear metal (hand tools - manually)	1	2	3	4	5
36. Flame cut steel plate or structural shapes using mapp gas	1	2	3	4	5
37. Flame cut steel plate or structural shapes using natural gas	1	2	3	4	5
38. Flame cut steel plate or structural shapes using oxy-acetylene gas	1	2	3	4	5
39. Cut metal - machine power nibbler	1	2	3	4	5
40. Carbon arc welding (repair)	1	2	3	4	5
41. Carbon arc welding (production)	1	2	3	4	5
42. Case harden metals	1	2	3	4	5
43. Air carbon arc cutting and gouging	1	2	3	4	5
44. Gouging with flame (mapp, natural and/or oxy-acetylene gas)	1	2	3	4	5
45. Harden small metal parts with torch flame	1	2	3	4	5
46. Bronze weld ferrous metals	1	2	3	4	5
47. Soften, form and/or bend metal with flame	1	2	3	4	5
48. Arc weld (stick electrode) metal pieces in flat, horizontal and verticle-up position	1	2	3	4	5
49. Arc weld (stick electrode) metal pieces in the overhead position	1	2	3	4	5
50. Safely extinguish fires	1	2	3	4	5
51. Lead soldering (sheet metal)	1	2	3	4	5
52. Fuel gas - under water cutting	1	2	3	4	5
53. Follow directions given by signals (Auditory and Visual)	1	2	3	4	5
54. Clean and maintain welding area	1	2	3	4	5
55. Repair welding and cutting equipment	1	2	3	4	5

IV. Welding Tasks - Cont.

5. EI - Extremely Important (Perform Task Without Supervision)
 4. VI - Very Important
 3. I - Important (Perform Task With Supervision)
 2. MI - Moderately Important
 1. U - Unimportant (Does Not Perform The Task)

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	<u>U</u>	<u>MI</u>	<u>I</u>	<u>VI</u>	<u>EI</u>
56. Keep records of jobs completed	1	2	3	4	5
57. Get along with fellow employees	1	2	3	4	5
58. Communicate with fellow employees (written and oral)	1	2	3	4	5
59. Treat <u>minor</u> (first aid) injuries	1	2	3	4	5
60. Store supplies	1	2	3	4	5
Set-up, adjust and operate according to work order, blueprint, layout and operating chart the following:					
61. Hardness testing equipment	1	2	3	4	5
62. Dye penetration equipment	1	2	3	4	5
63. Magnaflux equipment	1	2	3	4	5
64. Tensile testing equipment	1	2	3	4	5
65. Abrasive cutting wheel equipment	1	2	3	4	5
66. Punch press equipment	1	2	3	4	5
67. Rolling equipment	1	2	3	4	5
68. Blast cleaning equipment	1	2	3	4	5
69. Fine polishing equipment	1	2	3	4	5
70. Drilling equipment	1	2	3	4	5
71. Commonly used arc welding equipment	1	2	3	4	5
72. Gas fuel cutting equipment	1	2	3	4	5
73. Turntable equipment	1	2	3	4	5
74. Power shearing equipment	1	2	3	4	5
75. Other: _____	1	2	3	4	5
76. Other: _____	1	2	3	4	5
77. Forge hot metal (hammer - manually).	1	2	3	4	5
78. Read a vernier	1	2	3	4	5
79. Prepare finished parts and assemblies for shipment (count parts, compare quantity and identification numbers of items with order number, etc.)	1	2	3	4	5
80. Inventory (help with annual shop inventory)	1	2	3	4	5
81. Compute simple mathematical problems related to metal fabrication and repair	1	2	3	4	5
82. Keep accurate time reports (How long it takes to weld, cut, etc.)	1	2	3	4	5
83. Hand punch or drill holes in sheet metal preparatory to riveting .	1	2	3	4	5
84. Prepare a personal data sheet to present with the job application form	1	2	3	4	5
85. Other: _____	1	2	3	4	5
86. Other: _____	1	2	3	4	5
87. Other: _____	1	2	3	4	5

APPENDIX J

This appendix contains a copy of the forward letter and return post card used to announce the survey project indicating their desire to participate, or not participate in this study.



BLACKHAWK TECHNICAL INSTITUTE

VOCATIONAL, TECHNICAL AND ADULT EDUCATION DISTRICT FIVE

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SERVING ROCK AND GREEN COUNTIES

February 28, 1974

O. L. JOHNSON
District Director

ADMINISTRATIVE CENTER
2228 Casser Avenue
Janesville, Wisconsin 53545
1-608-754-0133

Dear Sir:

The Welding Department of Blackhawk Tech is conducting a research survey to assess the current employment trends, educational skills and competencies weldors should possess upon being employed in the welding establishments of the District. Since your firm is one of the industrial plants in the area employing weldors, you can help us in updating the Welding Program to meet your needs.

The study is being undertaken to identify:

- (1) The trends and hiring policies of the welding industries in Rock and Green counties.
- (2) The tools and equipment a beginning weldor should purchase upon being employed in your department.
- (3) The kinds of welding processes, their importance and future trends, presently being used in the District's welding firms.
- (4) The professional ratings of the tasks industry feels beginning weldors should know and be able to perform upon being employed in your department.

To obtain the information pertinent to this study, Gerald E. Lesch, Blackhawk Tech welding instructor, will be administering the survey. Will you help by allowing him to speak with you or your welding supervisor. The information collected will be handled in a strictly confidential manner and therefore your firm will not be identified with specific responses.

Please indicate your agreement to participate in the survey by filling out the enclosed self-addressed postcard and drop it in the mail today. All participating industries will receive a copy of the survey results.

Thank you for your assistance and please feel free to visit our school any time the opportunity presents itself. If we may be of any service to you, please let us know.

Sincerely yours,

Orvis L. Johnson
District Director

hm
enc.

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Blackhawk Tech
1149 Fourth Street
Beloit, Wisconsin 53511

ATTENTION: Gerald Lesch

To: Gerald E. Lesch

_____ Yes, I will be happy to participate in the Blackhawk
Technical Institute Welding Survey. Please contact
the following for an appointment:

Name: _____

Company: _____

Address: _____

City: _____ Phone: _____

_____ No, we will not be able to participate

APPENDIX K

This appendix lists the names and addresses of the welding companies returning post cards and wishing to participate in the survey.

APPENDIX K

The following list consists of the names and addresses of the welding companies returning post cards and wishing to participate in the survey:

A & B Sheet Metal Company
51 East Holmes
Janesville, Wisconsin 53545

Advance Transformer
350 21st Street
Monroe, Wisconsin 53566

Akey Machine And Welding
112 North Richards Street
Orfordville, Wisconsin 53576

Baker Manufacturing Company
133 Enterprise Street
Evansville, Wisconsin 53536

Beloit Corporation
Saint Lawrence Avenue
Beloit, Wisconsin 53511

Dana Corporation
1220 Fulton Street
Edgerton, Wisconsin 53534

Eastman Manufacturing Company
219 East Milwaukee Street
Janesville, Wisconsin 53545

Fairbanks Morse & Company
Colt Industries
Park Avenue
Beloit, Wisconsin 53511

Gilman Engineering & Manufacturing
Corporation
305 West Delavan Drive
Janesville, Wisconsin 53545

Highway Trailer Manufacturing
Corporation
405 East Fulton Street
Edgerton, Wisconsin 53534

Hough Manufacturing Company
1029 South Jackson Street
Janesville, Wisconsin 53545

Industrial Combustion Company
351 21st Street
Monroe, Wisconsin 53566

Janesville Construction Company
227 South Crosby Avenue
Janesville, Wisconsin 53545

Knight Manufacturing Company
1401 8th Avenue
Brodhead, Wisconsin 53520

Monroe Machine & Welding
907 7th Avenue
Monroe, Wisconsin 53566

Moore Business Forms, Inc.
350 17th Street
Monroe, Wisconsin 53566

Northern Petro Chemical
2200 Foster Avenue
Janesville, Wisconsin 53545

Norwood Mills
2101 Kennedy Drive
Janesville, Wisconsin 53545

Nutrena Mills - Division Of
Cargill Inc.
411 South Pearl Street
Janesville, Wisconsin 53545

Studer Super Service
1703 6th Street
Monroe, Wisconsin 53566

The Schlueter Company
112 East Centerway
Janesville, Wisconsin 53545

T. S. Willis
1 - South Main Street
Janesville, Wisconsin 53545

Varco Pruden, Inc.
Plant No. 1
273 Water Street
Evansville, Wisconsin 53536

Wisconsin Knife Works
2710 Prairie Avenue
Beloit, Wisconsin 53511

Wright & Wagner Dairy
Betrice Foods, Inc.
525 Cross
Beloit, Wisconsin 53511

APPENDIX L

This appendix lists the names and addresses of the companies wishing to participate in the survey after a follow-up of non-responders was conducted.

APPENDIX L

The following list consists of the names and addresses of the companies wishing to participate in the survey after a follow-up of non-respondents was conducted:

A & B Sheet Metal Company 51 East Holmes Janesville, Wisconsin 53545	Custom Welding Front Street Clinton, Wisconsin
Advance Transformer 350 21th Street Monroe, Wisconsin 53566	Dana Corporation 1220 Fulton Street Edgerton, Wisconsin 53534
Akey Machine And Welding 112 North Richards Street Orfordville, Wisconsin 53576	Dean Foods, Inc. 216 Center Avenue Janesville, Wisconsin 53545
Baker Manufacturing Company 133 Enterprise Street Evansville, Wisconsin 53536	Durst Corporation Post Office Box 298 Beloit, Wisconsin 53511
Beloit Box Board Company 801 2nd Street Beloit, Wisconsin 53511	Eastman Manufacturing Company 219 East Milwaukee Street Janesville, Wisconsin 53545
Beloit Corporation Saint Lawrence Avenue Beloit, Wisconsin 53511	Fairbanks Morse & Company Colt Industries Park Avenue Beloit, Wisconsin 53511
B. J. T. Enterprises Highway 26 Milton, Wisconsin 53545	Frito Lay, Inc. 2810 Kennedy Drive Beloit, Wisconsin 53511
Burdick Corporation 15 Plumb Street Milton, Wisconsin 53563	Geo. A. Hormel Company 300 Kennedy Drive Beloit, Wisconsin 53511
Carter Machine Works 1217 12th Avenue Monroe, Wisconsin 53566	General Motors Assembly Division General Motors Corporation Janesville Plant 1000 Industrial Avenue Janesville, Wisconsin 53545
City Of Janesville Janesville, Wisconsin 53545	

Gilman Engineering & Manufacturing
Corporation
305 West Delavan Drive
Janesville, Wisconsin 53545

Helgesteel Corporation
2833 Milton Avenue
Janesville, Wisconsin 53545

Highway Trailer Manufacturing
Corporation
405 East Fulton Street
Edgerton, Wisconsin 53534

Hitzman Welding
Box 43
Brodhead, Wisconsin 53520

Hough Manufacturing Company
1029 South Jackson Street
Janesville, Wisconsin 53545

Industrial Combustion Company
351 21st Street
Monroe, Wisconsin 53566

Janesville Auto Transport Company
1263 South Cherry Street
Janesville, Wisconsin 53545

Janesville Construction Company
227 South Crosby Avenue
Janesville, Wisconsin 53545

Janesville Products
1107 First Center Avenue
Brodhead, Wisconsin 53520

Knight Manufacturing Company
1401 8th Avenue
Brodhead, Wisconsin 53520

Lyle T. Manley Company

Hanover, Wisconsin 53542

Monroe Machine & Welding
907 7th Avenue
Monroe, Wisconsin 53566

Moore Business Forms, Inc.
350 17th Street
Monroe, Wisconsin

Northern Conveyor Company
2200 Foster Avenue
Janesville, Wisconsin 53545

Norwood Mills
2101 Kennedy Drive
Janesville, Wisconsin 53545

Nutrena Mills - Division Of
Cargill, Inc.
411 South Pearl Street
Janesville, Wisconsin 53545

Parker Pen Company
219 East Court
Janesville, Wisconsin 53545

Rath Manufacturing Company
112 South Pearl Street
Janesville, Wisconsin 53545

Roy's Sanitary Dairy
1702½ 11th Street
Monroe, Wisconsin 53566

R. Mueller Cheese Factory
Equipment Company
1412 13th Street
Monroe, Wisconsin 53566

Studer Super Service
1703 6th Street
Monroe, Wisconsin 53566

Summit Machine Works, Inc.
Ry. 15
Beloit, Wisconsin 53511

Tang Industries - Beloit Power
Systems Division
701 Lawton Avenue
Beloit, Wisconsin 53511

The Schlueter Company
112 East Centerway
Janesville, Wisconsin 53545

T. S. Willis
1 - South Main Street
Janesville, Wisconsin 53545

United Industries, Inc.
1546 Henry Avenue
Beloit, Wisconsin 53511

Universal Foods, Inc.
1115 Elaine Drive
Beloit, Wisconsin 53511

Utzig Body Shop
1715 West Court Street
Janesville, Wisconsin 53545

Varco-Pruden, Inc.
Plant No. 1
273 Water Street
Evansville, Wisconsin 53536

Whitehead & Riese
1821 8th Street
Monroe, Wisconsin 53566

Wisconsin Knife Works
2710 Prairie Avenue
Beloit, Wisconsin 53511

Wisconsin Power & Light
Company - Rock River
Generating Plant
500 Public Avenue
Beloit, Wisconsin 53511

Wright & Wagner Dairy
Betrice Foods, Inc.
525 Cross
Beloit, Wisconsin 53511

Wilson & Shipler Construction
Company
Shirland Avenue and Hy. 15
Beloit, Wisconsin 53511

APPENDIX M

This appendix lists the names and addresses of the companies interviewed and who completed the survey forms.

APPENDIX M

The following list consists of the names and addresses of the companies interviewed and filling out the survey forms:

1. A & B Sheet Metal Company
Mr. S. J. Burke (Bob)
Owner
51 East Holmes
Janesville, Wisconsin 53545
Phone: 1-608-754-6157
2. Akey Machine And Welding
Mr. Ronald Akey
Owner
112 North Richards Street
Orfordville, Wisconsin 53576
Phone: 1-608-879-2740
3. Baker Manufacturing Company
Mr. Robert Harter
Assistance Foreman
133 Enterprise Street
Evansville, Wisconsin 53536
Phone: 1-608-882-5100
4. Beloit Box Board Company
Mr. Joe Chamberlain
Vice President
801 2nd Street
Beloit, Wisconsin 53511
Phone: 1-608-365-6671
5. Beloit Corporation
Mr. Forrest D. Knueppel
Welding Supt.
Saint Lawrence Avenue
Beloit, Wisconsin 53511
Phone: 1-608-365-3311
6. Burdick Corporation
Mr. Clarence A. Vierck
Foreman
15 Plumb Street
Milton, Wisconsin 53563
Phone: 1-608-868-7631
Phone: 1-608-868-9847
7. Carter Machine Works
Mr. Keith Baumister
Owner
1217 12th Avenue
Monroe, Wisconsin 53566
Phone: 1-608-325-4568
8. Custom Welding
Mr. Pete Tiffany
Owner
Front
Clinton, Wisconsin
Phone: 1-608-676-5516
9. Dana Corporation
Mr. Phillip E. Smith
Welding Engineer (Metallurgy)
1220 Fulton Street
Edgerton, Wisconsin 53534
Phone: 1-608-884-3488 (Ext. 387)
10. Dean Foods, Inc.
Mr. Leroy Jennfeldt
Manager
216 Center Avenue
Janesville, Wisconsin 53545
Phone: 1-608-756-2361

* Several of the companies that were interviewed, but did not fill-out the survey forms, are not included in this list.

11. Durst Corporation
Mr. Dave McClellan
Plant Manager
Post Office Box 298
Beloit, Wisconsin 53511
Phone: 1-608-365-2563
12. Eastman Manufacturing Company
Mr. Gary Beal
Plant Supt.
219 East Milwaukee Street
Janesville, Wisconsin 53545
13. Fairbanks Morse & Company
Colt Industries
Mr. Jack Rosencrance
Welding Supt.
Park Avenue
Beloit, Wisconsin 53511
14. Frito Lay, Inc.
Mr. Jim Spindler
Plant Engineer
2810 Kennedy Drive
Beloit, Wisconsin 53511
15. Geo. A. Hormel Company
Mr. Kenneth Regner (Ken)
Plant Engineer
300 Kennedy Drive
Beloit, Wisconsin 53511
16. General Motors Assembly Division
General Motors Corporation
Janesville Plant
Mr. Murry Frey
Plant Engineer
Mr. Howard Schueller
Maintenance Supt.
1000 Industrial Avenue
Janesville, Wisconsin 53545
Phone: 1-608-754-5521
17. Gilman Engineering & Manufacturing Corporation
Mr. John Shedd
Mgr. Mfg.
305 West Delavan Drive
Janesville, Wisconsin 53545
Phone: 1-608-756-1211
18. Helgesteel Corporation
Mr. Marvin L. Helgesen
Iron Worker
Mr. Donald Helgesen (Don)
President
2833 Milton Avenue
Janesville, Wisconsin 53545
Phone: 1-608-752-9033
19. Hitzman Welding
Mr. Robert Hitzman
Owner
Box 43
Brodhead, Wisconsin 53520
Phone: 1-608-897-2559
20. Hough Manufacturing Company
Mr. Robert W. Gestner
Plant Manager
1029 South Jackson Street
Janesville, Wisconsin 53545
21. Industrial Combustion Company
Mr. Donald Avery
Welding Foreman
351 21st Street
Monroe, Wisconsin 53566
22. Janesville Auto Transport Co.
Mr. Bud Arenz
Supt.
Mr. Robert Wyss
Director of Maintenance
1263 South Cherry Street
Janesville, Wisconsin 53545
Phone: 1-608-754-5561
23. Janesville Construction Co.
Mr. William P. Ryan
Owner
227 South Crosby Avenue
Janesville, Wisconsin 53545
Phone: 1-608-752-8058
24. Janesville Products
Mr. Anthony Wasmer
Maintenance Supervisor
1107 First Center Avenue
Brodhead, Wisconsin 53520
Phone: 1-608-897-2172

25. Knight Manufacturing Company
Mr. Stanley Knight
Owner
1401 8th Avenue
Brodhead, Wisconsin 53520
Phone: 1-608-897-2131
26. Lyle T. Manley Company
Mr. Harold Gilmore
Plant Foreman

Hanover, Wisconsin 53542
Phone: 1-608-
27. Monroe Machine & Welding
Mr. Dick Feller
Owner
907 7th Avenue
Monroe, Wisconsin 53566
Phone: 1-608-325-8127
28. Moore Business Forms, Inc.
Mr. Homer Wiemer
Maintenance Foreman
Mr. George Cromwell
Foreman
350 17th Street
Monroe, Wisconsin 53566
Phone: 1-608-325-9111
29. Northern Conveyor Company
Mr. Richard Reis
Executive Vice President
Mr. William Taubert
Plant Supt.
2200 Foster Avenue
Janesville, Wisconsin 53545
30. Norwood Mills
Mr. Werner Randell

2101 Kennedy Road
Janesville, Wisconsin 53545
Phone: 1-608-756-0321
31. Nutrena Mills - Division Of
Cargill, Inc.
Mr. Charles Van Blaricom
Supt.
411 South Pearl Street
Janesville, Wisconsin 53545
Phone: 1-608-754-3371
32. Parker Pen Company
Mr. Nick E. Szews
Plt. Maint. Eng.
219 East Court
Janesville, Wisconsin 53545
Phone: 1-608-754-7711
33. R. Mueller Cheese Factory
Equipment Company
Mr. Paul Mueller
Owner
1412 13th Street
Monroe, Wisconsin 53566
Phone: 1-608-325-5817
34. Studer Super Service
Mr. Fred Studer
Owner
1703 6th Street
Monroe, Wisconsin 53566
Phone: 1-608-325-2128
35. Beloit Power Systems Division
Tang Industries
Mr. Andrew J. Cox
Personnel Director
701 Lawton Avenue
Beloit, Wisconsin 53511
Phone: 1-608-365-4491
36. The Schlueter Company
Mr. Bud Losching
President
Mr. Donald Martin (Don)
112 East Centerway
Janesville, Wisconsin 53545
Phone: 1-608-754-3358

37. Universal Foods, Inc.
Mr. Joe DeNucci
Manager
1115 Elaine Drive
Beloit, Wisconsin 53511
Phone: 1-608-365-9531
38. Utzig Body Shop
Mr. David Utzig
Owner
1715 West Court Street
Janesville, Wisconsin 53545
Phone: 1-608-752-7727
39. Varco-Pruden, Inc.
Plant Number One
Mr. Robert Levin
General Manager
273 Water Street
Evansville, Wisconsin 53536
Phone: 1-608-882-5000
40. Whitehead & Riese
Mr. Stanley Whitehead
Owner
Mr. Paul Hanson
Traffic Manager
1821 8th Street
Monroe, Wisconsin 53566
Phone: 1-608-325-2308
41. Wisconsin Knife Works
Mr. William Long (Bill)
Supervisor of Maintenance
2710 Prairie Avenue
Beloit, Wisconsin 53511
Phone: 1-608-365-9581
42. Wisconsin Power And Light Co.
Rock River Generating Plant
Mr. B. G. Rosander
Assist. Mt.
500 Public Avenue
Beloit, Wisconsin 53511
Phone: 1-608-362-6242
43. Wright & Wagner Dairy
Mr. Erich Vogt
Engineer
525 Cross
Beloit, Wisconsin 53511
Phone: 1-608-365-5561